ELECTRONICS Australia

with CB and HIFI NEWS

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TC788-4

TC880-2

Sony Reel-to-Reel Decks

If you're through fooling around with Hi-Fi and are ready for some serious sound experiences, get creative with a studio-quality reel-to-reel deck by Sony.

Sony started out first – with Japan's first-ever magnetic tape recorder back in 1950. And in the 28 years since we've maintained our position by applying the results of our massive research into continuing improvements in every aspect of reel-to-reel deck design and manufacture.

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Take our state-of-the-art TC880-2 for instance:

- Sony's famous closed-loop dual-capstan drive with Direct Tape Drive gives exceptionally low wow & flutter of 0.02%
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- Built-in differential amplifier and phase compensator circuit reproduce sound so accurately as to be indistinguishable from source
- Foolproof logic controls with full range of bias and equalisation switches
- Synchro track facility allows sound-on-sound with no time lag for accurate after recording or sound editing.

And if your musical ideas need a studio-quality 4 track record and playback facility go no further than Sony's mighty TC788-4

- Full versatility with 4 track 4 channel recording and playback, 4 track 2 channel recording and playback, or "Pan-pot" for front to back mixing.
- Synchro track feature for sound-on-sound with no time lag, accurate 'after recording' or sound editing
- All the other features that have made Sony No. 1 in reel-to-reel, such as closed-loop dual-capstan drive, 3 heads for simultaneous monitoring; servo-controlled 3 motor system for accurate tape transport.

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VOL. 39 No. 12 MARCH, 1978

Designed in our laboratory, this new RLC bridge can measure resistors from 10 ohms to 10M, capacitors from 10pF to 10uF, and inductors with values down to a few hundred uH. Details on p40.

Minicatalog:

See centre four pages for minicatalog of Trio and B&K instruments for the hobbyist & professional.

On the cover

Due for release in Australia later this month, Tandy's new TRS-80 microcomputer will sell for just $800 and yet offers facilities until now found only on systems costing $15-20,000. EA Editor Jim Rowe's exclusive review of the first TRS-80 system to reach Australia begins on p10. (Picture courtesy Tandy International Electronics).

FEATURES

HIFI NEWS & REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

How to get the sound of a whole new hi-fi system for around $35

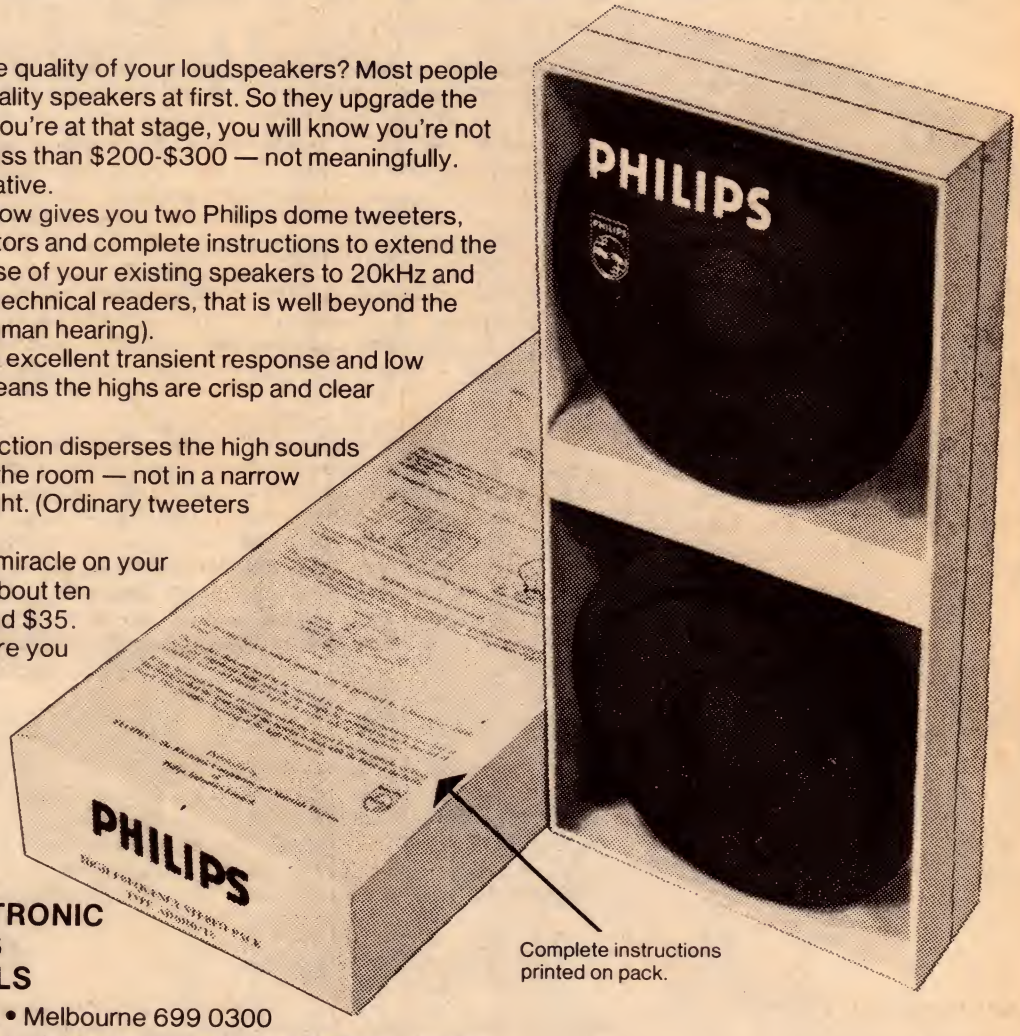
Are you sure of the quality of your loudspeakers? Most people can't afford top quality speakers at first. So they upgrade the speakers later. If you're at that stage, you will know you're not going to do it for less than $200-$300 — not meaningfully. We offer an alternative.

The Elcoma kit below gives you two Philips dome tweeters, cross-over capacitors and complete instructions to extend the frequency response of your existing speakers to 20kHz and beyond. (For non-technical readers, that is well beyond the range of normal human hearing).

And they do it with excellent transient response and low distortion. (That means the highs are crisp and clear without grating).

The dome construction disperses the high sounds naturally all round the room — not in a narrow beam like a flashlight. (Ordinary tweeters can do that).

You can work this miracle on your stereo system in about ten minutes. For around $35. Why not try it before you write a cheque for $300?



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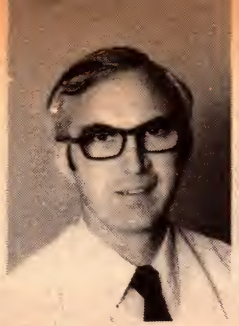

Editorial Viewpoint

Self regulation or suppression?

Before CB radio was legalised last year, we heard a great deal about its potential benefits for Australian society. There was much talk of its value as a communications medium in emergencies such as road accidents, bush fires and floods, and of its use by citizens to alert the police to suspected crimes in progress.

I have no doubt that CB radio does have these potential benefits for society, and that since legalisation they have even been realised from time to time. However what has become much more obvious is CB's potential in less desirable directions.

Listen on the CB channels in almost any of our larger cities, and you'll discover what I mean. You'll hear everything from schoolkids swapping dirty yarns and planning gang escapades, to prostitutes touting for business. And in the daily papers stories on the abuse of CB are now becoming quite frequent. It seems possible that CB may even have played a key role in a recent murder.

In short, CB radio is becoming notorious. So much so that there is a growing backlash, and many people are seriously suggesting that the authorities should reverse last year's decision, and try to suppress CB altogether.

Frankly I think this would be quite unrealistic. If it was not possible to stop 40,000-odd illegal operators before legalisation, what chance would the authorities have now of stopping ten times that number?

It is really too late now for second thoughts. CB radio has become a part of our society, for better and for worse. And the fact is, of course, that CB itself is neither good nor bad — apart from the problems of interference. Essentially it is merely yet another technological means of extending and enlarging our own human characteristics, the desirable as well as the less desirable.

This is not to say that we should simply shrug our shoulders and assume that nothing can, or should, be done to improve the present chaos on CB channels in the cities. On the contrary, I think considerable improvement can be made if all sincere and responsible CB users exert retrained but consistent pressure on those who are acting in anti-social ways. In other words, voluntary self regulation.

If this is not done, the backlash against CB may build up to such a level that the authorities may be forced into attempting complete suppression. Or perhaps worse still, we could see the growth of self-appointed "CB vigilante" groups, using violence to exert their will on CB users.

Jamieson Rowe

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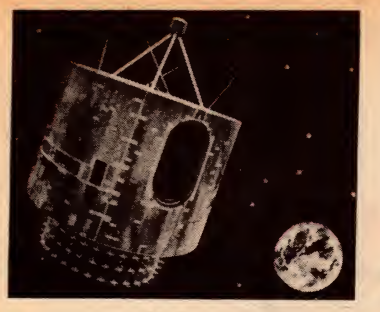


News Highlights

Local industry lobbies for defence contracts

Communications projects . . .

Two major policy developments in the defence field expected soon could significantly affect the future of Australia's struggling defence electronics industry.

The industry's association, the Australian Telecommunications Development Association, is hoping that the decisions will make a firm commitment to the local manufacturers.

The first of the developments is a proposed, but as yet undeclared, extension of our territorial waters to a 320km limit; the second is a policy shift to a more stringent application of the Australian Industry Participation (AIP) principle.

Already, planners in Canberra's Russell Hill Complex are proceeding with at least half a dozen projects which could help to revitalise the industry.

Among these projects are "Humpty Doo", which is both a designation and the name of the Northern Territory site of a new high frequency, high powered radio transmitting station for the Navy. Others which require explanation are "Hiport-Medport", "Raven" and "Discon", all of them code names for projects considered necessary for Australia's defence.

"Hiport-Medport" covers a planned air transportable radio communications system based on mobile radio communication posts that would be used in any integrated forward defence of Australia.

"Raven" is more than a single project; it involves a whole new generation of tactical single channel radio transmitting and receiving equipment for the Army. Its scope is most easily understood in terms of the money involved — $100 million.

"Discon" is an acronym for Defence Intergrated Secure Communications Network, and involves the establishment of a nationwide top secret communications complex for combined operations by the Defence Department.

While these defence tasks are quite specific, there are many others that are not, although they are now in the melting pot and will require decisions before very long. Not surprisingly, the 320km zone will have a heavy bearing on the defence planners eventual decisions.

An electronic "fence" around this zone is not only the ideal, but the only practical way in which a nation with such a huge land mass, with a population of only 14 million, and with a non-existent coast guard, can adequately protect these new outer limits.

. . . and new aircraft

The Air Force and Navy are examining new aircraft with capabilities that will make the overall task a little easier.

In its search for a replacement for the ageing Mirage Interceptors, the Air Force is also looking at high speed aircraft such as the Grumman F-14 Tomcat (the US Navy's frontline fighter), the McDonnell-Douglas F-15 Eagle, the General Dynamic's F-16, and the Panavia Tornado, a joint effort of the Italian, British and West German aerospace industries.

For its part, the Navy is very interested in the Sea Harrier, which has both vertical lift and strike capacity and can be launched from the more conventional type of surface vessels.

Whatever the choices they will be required to have sufficient range to operate in defence contingencies along our "fence" and to be equipped with sophisticated avionics capable of extending Australia's long range defence surveillance.

"Low-cost", automatic star mapping

The University of Western Australia has released details of a newly-patented device which will make automatic mapping of the heavens a feasible proposition for many smaller observatories throughout the world.

The machine, invented by Dr John Mills of the University's Department of Electrical and Electronic Engineering, automatically measures the position, size, etc. of the images of heavenly bodies recorded photographically via telescope on standard "star plates".

Currently available instruments with a similar capability cost $500,000 and upwards. It is estimated that the new machine can be made available for less than $100,000.

Held against the star plate when it is in the machine is an accurate graticule or mesh which divides the area of the plate into a series of one millimetre squares. Under computer control, the probe places itself over each square in succession. When it has positioned itself accurately, the area is scanned by a point of light which is generated on the screen of a cathode ray tube and focused onto the square under examination.

A light sensitive device on the other side of the plate records changes in intensity of the light as images of stars are traversed.

The probe then moves to the next square and the process is repeated. The results are punched onto paper tape and at a later stage converted to a directly readable printout or processed further on another computer.

Business Brief

Electronic Disposals has announced the opening of a new store at 289 Latrobe St, Melbourne, 3000 (telephone 663-1785). The new store, called "Ellistronics", has around 220 square metres of air-conditioned display space on the ground floor, while the first floor will be used mainly for offices and storage. Proprietor of the new store is Jack Ellis.

What are microprocessors used for?

One of the most extensive — and expensive — studies of the applications of microprocessors is to be carried out by Arthur D. Little (ADL), working in conjunction with Cambridge Consultants, England.

The budget for the report has been provisionally set around the £400,000 mark. It will take the form of a multi-client study, with ADL assuming responsibility for operations in North America and Cambridge Consultants and ADL branch offices for the work in Europe.

The purpose of the study is to provide industry subscribers with basic information on microprocessor applications, markets, technological developments, suppliers, and product and resource requirements. Sponsors have already come in from the US, Europe and Japan, and include large companies in consumer electronics, automobiles, security equipment, instrumentation and the toy industry.

New version of the video disc

Matsushita Electrics has unveiled its own version of the video disc — a 1- or 2- hour player unit capable of playback in colour and with stereo sound.

Main advantages of the new Matsushita system, said to be different from other video disc technologies, are that the player and plastic discs can be easily mass-produced. Another advantage is that the time required for cutting master records is said to be relatively short compared to the other systems.

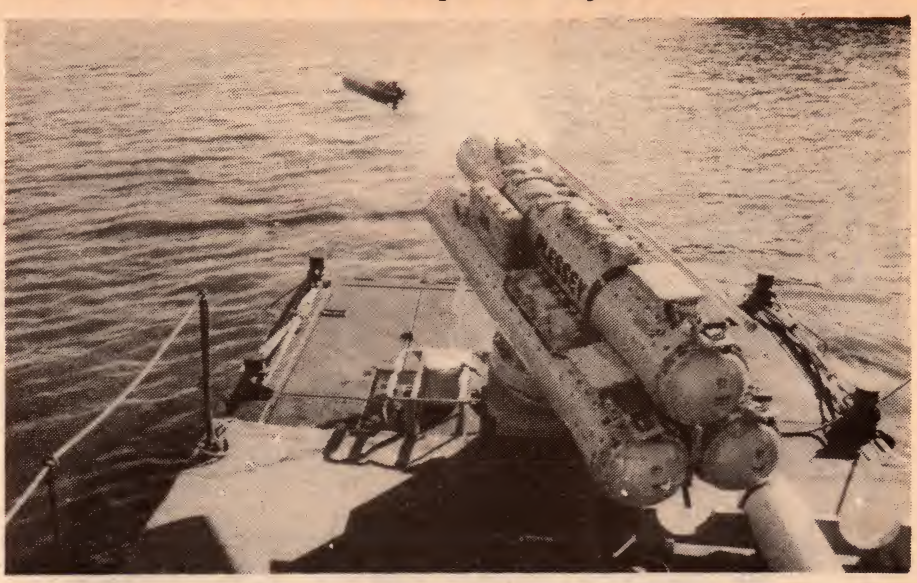
Matsushita says that a player could be marketed in Japan at a price somewhere between $480 and $600. Actual production will depend on the interest shown by program companies and the film industry.

Monster magnet

The US Energy Research and Development Administration (ERDA) has announced that the world's first large superconducting magnet designed to be used in a magneto-hydrodynamic (MHD) generator has been successfully tested at its Argonne National Laboratory near Chicago.

MHD devices must produce a strong magnetic field, through which a high-speed stream of hot, electrically conductive gas flows to generate electricity. The monster magnet at Argonne, which must be cooled to roughly -270°C, weighs 45 tonnes and produces a magnetic field of 50,000 gauss.

Anti-submarine weapons system



A practice torpedo is launched into London's River Thames as part of the demonstration of a new self-contained computerised torpedo weapon system. Designated the STWS 1 (Shipborne Torpedo Weapon System Mark 1), it has been developed by Plessey Marine under the guidance of Britain's Admiralty Underwater Weapons Establishment, to provide an effective close range anti-submarine weapon for ships of the Royal Navy.

Because the STWS 1 incorporates its own autonomous computer it can launch an effective close-range anti-submarine attack even if the ship's centralised computer system is out of action. It is suitable for fitting in almost all classes of vessel and can be used with any known sonar system.

Too many CB's, says Vicom

A spokesman from Vicom International, an importer of CB and communications equipment, said recently that export figures for CB radios from Japan proved that the Australian market was over supplied.

Figures supplied by official Japanese export sources show that during 1976 and up to August 1977, 241,000 CB units were exported to Australia from Japan alone.

The spokesman said that additional imports of CB radios from the USA meant that the Australian market had absorbed 380,000 sets by the end of last year.

The company claimed that the confusion and price wars waged in the retail trade were easily understood in the light of these figures, and predicted that many small importers and retailers would "go to the wall" as a result of unsaleable and non-approved stocks still on the shelves after December 31st.

December 31st was the cut-off date for all 23 channel radios. Only approved 18 channel sets are now being licensed by Australian authorities.

Energy self-sufficiency for Britain

By 1980 Britain confidently expects to be one of very few advanced industrial countries self-sufficient not just in oil — as the benefits of large discoveries in the North Sea are reaped — but in energy as a whole. Despite continuous extraction for more than 100 years, Britain still has vast proven reserves of coal which are being added to almost weekly as exploration continues.

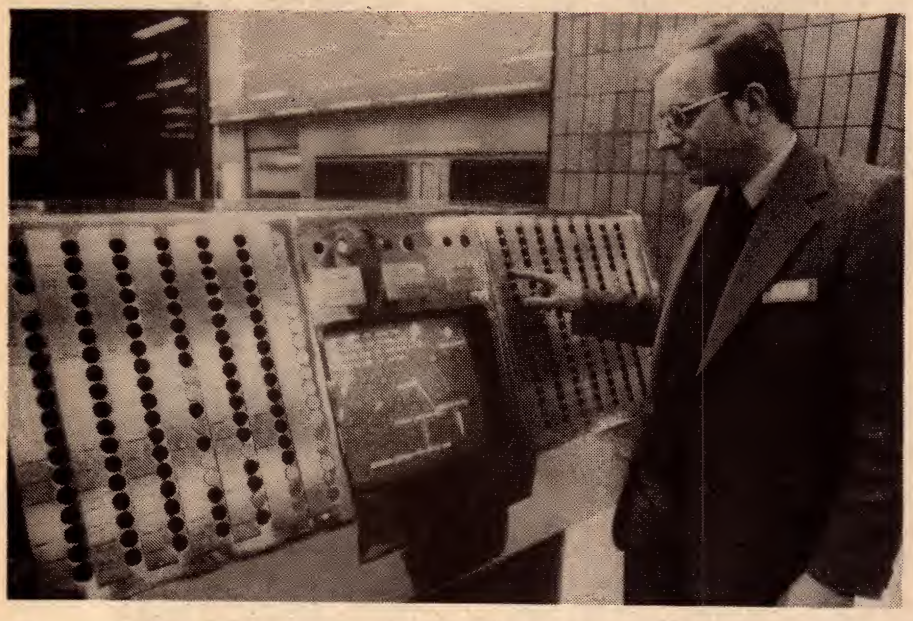
Plans are being implemented to sink large new pits to exploit discoveries like those at Selby in northeast England, where production of 10 million tonnes a year is planned. Large reserves of natural gas have been discovered in the North Sea. And Britain generates about 15 percent of her electricity in nuclear power stations.

The main thrust toward self-sufficiency will come from the North Sea oil discoveries, with an output expected to build up to 100 million tonnes a year by 1980. This will meet all Britain's needs and, in fact, it is expected that as the decade proceeds there will be substantial net exports of oil.

The revenues from North Sea oil provide an opportunity to solve Britain's industrial problems rather than a panacea. During the last decade Britain has enjoyed steady if unspectacular growth, but has fallen behind competing nations such as West Germany.

NEWS HIGHLIGHTS

Electronic journey planner



To get from the airport to a destination in London? — just press a button and your route appears on the television screen. This British-made computer-controlled journey planner provides users of the new Heathrow Central underground station at Heathrow airport with an instant read-out of route information in three languages.

The terminus of the £30 million Piccadilly Line extension, opened last December, makes Heathrow the first international airport to be directly linked with the underground system of a major capital city.

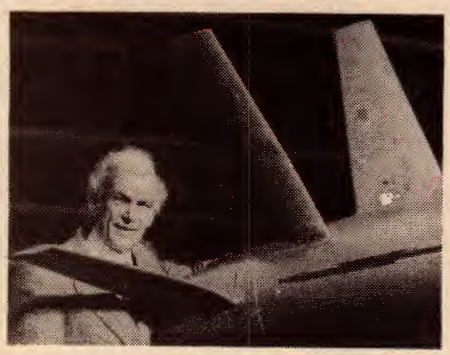
Both the hardware and the software of the journey planner were designed and produced by a British consultancy house. The machine is a completely self-contained, vandal-proofed, autonomous microcomputer.

"Mini-sails" may cut aircraft drag

Small tabs fitted to the wingtips of aircraft could substantially reduce drag, improve aircraft handling and reduce fuel consumption, according to the preliminary results of research undertaken in Britain. Experimental versions of the tabs are seen in the accompanying photograph fitted to the rear of the tip-tank of a light aircraft.

Known as mini-sails, they are the idea of the Cranfield Institute of Technology, where two researchers, Mr. J. J. Spillman (seen here) and Mr. J. E. Allen have found that three or four tabs grouped round the rear half of each wingtip can considerably reduce vortex drag.

The value of the tabs is said to be their ability to transform the air flow around the wingtip from a drag-producing vortex, or spiral, to a steady stream or curtain. The absence of turbulent air at the wingtips could, for example, smooth the low-level low-speed flight of crop spraying aircraft and enable them to deliver chemicals with greater accuracy.



Tests in wind tunnels and on an aircraft in flight have confirmed that a single tab sail on each wing reduces drag by 9%, while three sails per wing can cut vortex drag by as much as 29%.

Further work on the project is being carried out with financial backing from the National Research Development Corporation. This will be concerned with the possibility of varying the angle of the tabs in flight — a development that could produce special advantages for advanced planes of the future.

Dick Smith to distribute Yaesu Musen

The Dick Smith Electronics Group has announced that they will now be directly distributing Yaesu Musen amateur communications products in Australia. And, according to Dick Smith, his company is "very excited to be marketing such excellent quality equipment".

Dick Smith has been negotiating for a number of years to obtain such a distributorship. He now says that he will "promote amateur radio in Australia like it has never been promoted before".

As a first step, Dick has announced plans to publish the first Australian book on amateur radio for many years, with the co-operation of the Wireless Institute of Australia.

New Tandy dealerships

With over 100 branch stores already operating around Australia, Tandy Electronics plan to move into a new marketing phase by arranging supplementary dealerships in areas not already served by the branch stores. It is envisaged that the dealerships will be taken up by a variety of existing stores, who will be accredited by Tandy, and supported by signwriting, literature, advertising and listing in the company's catalogs.

Tandy dealers will carry, by mutual arrangement, any or all of the lines under the Tandy and Realistic label, according to the opportunities available.

While the dealerships represent a new venture in Australia, they are an established part of the Tandy marketing scene in the USA and Canada, with literally thousands of stores being included in the chain.

Postal field trials for facsimile systems

In a move towards increased electronic mail in Australia, Telecom Australia has called tenders for the supply of up to 20 facsimile units for "postal field trials". Trials of the finally selected units would begin by the end of the year on routes to be selected and for applications over and above those used by presently installed facimile systems.

Telecom is looking for 12 to 20 facsimiles initially of the 3-minute speed variety — ie. the machine must be capable of transmitting a page size document over the telephone lines in around 3 minutes.

Telecom's interest in facsimile technology parallels a major interest by suppliers and distributors who see a potential communications boom.

ELECTRONICS TRAINING IN TODAY'S AIR FORCE.

If you're aged between 17 and 34 and you're into radio equipment, navigation aids, computers, radar and advanced telecommunications equipment, the Air Force can train you as a radio technician.

You'll work with people your own age on good pay — $9,936 per year on completion of training. You'll have the chance to travel, and a secure future.

And, when in due course you leave the Air Force, there are tremendous opportunities in civilian life. Training is free, so is medical, dental and optical care, and you'll be eligible for a low interest housing loan, after 3 years.

So if you're between 17 and 34 on entry, an Australian citizen, and meet our nationality requirements and have good results in English, Maths and Science, give the Air Force a call.

You're future's in your hands.
Brisbane: 226 2626, Townsville: 71 3191,
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RG55.FP57

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NATIONAL ANTHEM

ALL THE NEWS THAT FITS

A Review of New Products and Literature from National Semiconductor

New in PACE family: n-channel, 16-bit MPU

Our INS8900 microprocessor is intended for applications which require the efficiency of a 16-bit word length, yet it is priced the same as many 8-bit microprocessors.

Housed in a standard 40-pin ceramic DIP, the INS8900 is built with n-channel silicon-gate technology. It's a true 16-bit CPU with 16-bit instruction words and 16-bit data words, all handled by a powerful, efficient, and flexible set of 45 instructions.

The single-word 16-bit format of the instructions reduces memory accesses and program storage requirements. And because it can operate on both 8-bit and 16-bit data words, the INS8900 extends its efficiency and power to 8-bit applications as well.

Features of the new MPU, for which a full family of peripheral circuits is planned, include multiple addressing modes, four general-purpose accumulators, byte and word processing, common memory and peripheral addressing, six hardware vectored priority interrupts, a ten-word stack, four control flag outputs, three sense inputs, four I/O control strobe signals, a single-phase 2-MHz clock, and low-power-Schottky-compatible outputs. And all of this is yours at a high-volume pricing of less than $10.

65 K static ROM features high speed, low power

We call it the MAXI-ROM™: 8192 × 8 bits of static, fully decoded, read-only memory with an access time of 800 ns maximum. And because our MAXI-ROM has timing requirements identical to those of static RAMs, you need only one clock for both RAM and ROM store.

Officially called the MM4235/MM5235, this new mask programmable metal-gate MOS ROM is an n-channel device and operates from a single 5-V supply. Its inputs are TTL compatible, as are its Tri-State®, OR-tie-compatible outputs. Further, the MAXI-ROM has three programmable chip-select inputs for easy, wire-OR'd memory expansion.

Right now, all of this comes to you in a 28-lead package; shortly, look for another version of the MAXI-ROM in the 24-lead 2316E pin-out.

3½-digit DPM on a single chip

Okay—you've asked for it, now you've got it. We proudly announce our ADD3501/ADD3701 and ADD3511/ADD3711 DPMs-on-a-chip. While the 3501 is intended for instrumentation-type uses, the 3511 is designed to interface with microprocessors. With its addressable BCD outputs, the 3511 is ideal for MPU-based system A/D uses and is the first of its kind available in the industry.

The results of an extensive survey of your DPM needs, the ADD3501 and ADD3511 incorporate just about everything you've told us you want.

To start with, we've put it all on a TTL-compatible, single CMOS chip that runs from a single 5-V supply (45 mW drain) and requires only two external parts—a reference and a digit driver. By switching external resistors you get two scale ranges: ±0.1999 V and ±1.999 V for the ADD3501, or ±0.3999 and ±3.999 for the ADD3701 (ideal for electronic weight scales, azimuth indicators, and so on), and to an accuracy of one count from 0° to +70°C.

And these units are National proprietary designs that use pulse modulation A/D conversion techniques, rather than dual-slope techniques. This method of conversion eliminates precision external components, and lets you use a single reference voltage of the same polarity as the input signal. The use of a single, isolated power supply for the whole DPM, by the way, allows the conversion of positive and negative voltages. The ADD3501/ADD3701 automatically outputs the proper sign and, also automatically, displays +OFL or −OFL in case of an overrange situation.

You can use either an external RC network or an external signal source to control the DPM's on-chip clock (100-640 kHz), which in turn sets the conversion rate to $64,256/f_{in}$ conversions per second. The digit multiplexing is synchronized with the A/D conversion timing to eliminate noise from power supply transients.

Other features of the ADD3501/ADD3701 are a FET input circuit, which draws an analog input current of only ±0.5 nA; a Start Conversion input and a Conversion Complete output; and a seven-segment LED drive for jitter-free displays to 0.5 inch. Our NSB5388, described in this issue, is a perfect companion for the 3501; and we've got a 3¾-digit display that's an ideal display-mate for the 3701, too.

Cutting it fine: a 4-bit bipolar MPU slice

The IDM2901A is a 4-bit microprocessor slice intended to be used either alone or cascaded in central processing units, programmable microprocessors, peripheral controllers—in fact, wherever high-speed applications demand economy, software/hardware flexibility, and easy expansion. Its building-block architecture and microinstruction format permit the IDM2901A to emulate most digital-based systems.

A low-power-Schottky part, the 40-pin IDM2901A features a multiple-address architecture, which improves system speed by providing simultaneous yet independent access to two working registers. Its multifunction ALU performs addition, two subtraction operations, and five logic functions on two source operands; for every ALU function, the IDM2901A selects data from five source ports for a total of 203 source operand pairs. And because left/right shifts are independent of the ALU, an arithmetic operation and a left or right shift are obtainable on the same machine cycle.

The IDM2901A has four status functions with carry, overflow, zero, and functional sign available as outputs. And it's microprogrammable, too, with three 3-bit groups for source operand, ALU function, and destination control.

The IDM2901A chip carries a 16-word by 4-bit two-port RAM, a high-speed ALU, and all required shifting, decoding, and multiplexing circuits. And it's *fast*. In fact, our IDM2901A is the fastest 2900-type MPU you can buy. We've proved it, and so can you. Check the IDM2901A's data sheet, then try the part itself. We're sure you'll like it.

Active filters, anyone?

National now has an extensive line of standard active filters. While many of these filters are intended for general purpose use up to 100 kHz, there is also a new family intended specifically for telephone equipment.

In the general purpose line our AF99, for example, is a tunable (60 to 270 Hz) high Q, band pass filter with a user-strappable bandwidth option of 2.5 to 5.0 Hz. Because it is also usable as an oscillator, the AF99 comprises a complete tone generating and receiving system in a single package—excellent for 2-wire tone-activated systems.

Our AF100 is a universal active filter that needs only four external resistors to program it for specific second-order functions. It features simultaneous and separate low pass, band pass, and high pass outputs; and independent Q (to 500), frequency (to 10kHz), and gain adjustments. The AF100 may be cascaded to realize higher-order systems. (In fact, we have a new filter to make that job even easier: our AF151, which combines two AF100s in a single package.) And the AF150—the newest member of our filter family—is a high-frequency version of the AF100, with operation extended to 100 kHz and the $Q f_c$ product increased to 200,000.

Then there's our AF120—a generalized impedance converter. Adding one external capacitor to this device turns it into the gyrator-equivalent of a grounded inductor; paired AF120s form ungrounded inductors or inductor networks. Two external capacitors turn the AF120 into a frequency-dependent negative resistance. In short, with appropriate transformations the AF120 makes it possible to realize any low-frequency ladder filter network.

Finally, we have a group of filters intended specifically for telephone transmission systems. The AF132, for example, combines transmit and receive filters in one package, and is for use in digital PBX equipment. The AF130 (transmit) and AF131 (receive) filters, on the other hand, are high quality, fifth order, elliptic low pass units intended for high-quality PBX and PABX equipment or D3 Channel Bank use. Yet another step up the chain are our premium, central-office quality AF133 (transmit) and AF134 (receive) filters. These allow you to meet all AT&T 2- and 4-wire specifications as well as the CCITT international specs for PCM exchange equipment. All these filters meet the stringent requirements of the telephone industry, and satisy all considerations of size, environment, life, and cost.

3½-digit, 0.5-in. LED display

Intended for digital instrumentation applications—power supply readouts, multimeters, panel meters, etc.—the NSB5388 is a common-cathode multiplexed display with separate access to the decimal points and ± signs. It is directly compatible with our ADD3501 DVM chip (story above).

Electrical specifictions include a typical light intensity of 1.6 mcd and forward voltage of 1.7 V.

Chip set for processor systems

We have a pair of CMOS/LSI circuits that we've dubbed LPCS—which stands for Low-power Programmable Calculator Set. The pair consists of the MM58101 (a Control ROM Element, or CRE), and the MM58102 (a Memory and Processor Element, or MPE). The two chips form a processor with an eight-bit instruction/four-bit data word architecture.

Originally designed for use in our combination calculator-watch products, the LPCS turns out to be ideal for any and all controller/timekeeping applications that demand a low-cost, micropower processor.

The LPCS directly drives seven-segment, six-digit liquid-crystal displays (with decimal points), and interfaces to 40-position keyboards. An on-chip 32.768-kHz oscillator provides not only all clock and control signals required for the LPCS to operate as a processor, but a 1-Hz program-controlled interrupt function as well.

A key feature of the set is its single-mask programmability: the 2048 × 8 ROM is mask-programmable to your own application requirements, and you talk to it via a set of 39 standard instructions. (In the MPE, there are 384 bits of RAM organized as eight 12-bit registers.)

Other features of the MM58101/MM58102 LPCS include operation from a single 3 V supply, an on-chip doubler to drive liquid-crystal displays, a general purpose output port, and three program-controlled I/O ports.

Our 80/10: alternate source, lower cost

National has entered the microcomputer marketplace with the introduction of our Series/80 BLC 80/10—a self-contained computer-on-a-board. The central processor, system clock, RAM/ROM store, I/O lines, serial communications interface, bus drivers and logic . . . all on a 6.75 × 12-inch PC board.

Our 80/10 is an alternate source for the Intel product—but at a price lower than Intel's. The lower price results not only from our automated assembly procedures, but also from a major use of our own components—something Intel cannot match.

The CPU, for example, is our own INS8080A; the 1K × 8 static read/write capability, our MM2711 RAMs; up to 4K × 8 read-only memory, our MM2708 PROMs or MM2308 ROMS, two INS8255 programmable interface circuits provide 48 I/O lines; an INS8251 USART; Teletypewriter* and RS232 interfaces; provision for up to six interrupt request lines; etc., etc.—you get it all.

And supporting the BLC 80/10 card itself is an army of other Series/80 cards: RAM boards, ROM/PROM boards, DMA boards, I/O boards, memory and I/O expansion boards, prototyping boards; and coming very shortly, full Series/80 systems and firmware.

With National as an alternate source, the 80/10 microcomputer emerges as the *de facto* industry standard. So get on the bandwagon today. Ask for our Series/80 literature. See what you've been missing— and how much you'll be able to save.

Voltage regulators— we have 'em

Innovative technology, quality of the highest order, competitive and better-than-competitive pricing, and minimum-lead-time delivery—these have made National the Number One supplier of linear circuits.

Our voltage regulator family is a good example of our leadership position. Already the most complete three-terminal regulator line in the industry, it's still growing, as this chart shows:

POSITIVE REGULATORS	
Fixed	
LM123	- 3.0A
LM140	- 1.5A
* LM140A	- 1.5A
LM141	- 0.5A
LM142	- 0.25A
LM140L	- 0.1A
LM78XX	- 1.5A
LM78MXX	- 0.5A
LM78LXX	- 0.1A
Variable	
LM117	- 1.5A
* LM150	- 3.0A
NEGATIVE REGULATORS	
Fixed	
LM145	- 3.0A
LM120	- 1.5A
LM120M	- 0.5A
* LM120ML	- 0.25A
* LM120L	- 0.1A
LM79XX	- 1.5A
LM79MXX	- 0.5A
* LM79LXX	- 0.1A
Variable	
* LM137	- 1.5A

The products marked here with an asterisk either have been introduced very recently, or will be available very shortly. Our LM140A/LM340A, for example, has performance unmatched by any other manufacturer, with nearly perfect line (0.06 %/V) and load (0.5 %/A) regulations and is fully spec'd at 1.0 A—not at 0.5 A. The LM340, in fact, has improved specs—right to the military limits—and slips into any 78LXX socket to give superior performance at no increase in cost.

Then there are the LM120ML/LM320ML (0.25 A) and LM120L/LM320L (0.1 A), negative regulators that complement the positive regulator versions, and which offer optimal price performance.

Two other bright new stars in our regulator galaxy are the LM150/LM350—a high power (3 A) version of our LM117/LM317, which was the industry's first adjustable regulator—and the LM137/LM337, which is an adjustable 1.5-A negative regulator that complements the LM117. We've improved reliability by 100 per cent burn-in testing, so these parts will reduce your inventory requirements and standardize packaging, while improving your system's performance.

Finally, there's our LM79LXX—a new regulator for negative, low-current applications, which we test to 100 mA (versus only 40 mA for competitive parts); even with only a 0.1-μF output compensation capacitor, this unit retains its excellent transient response, line regulation (0.07 %V$_o$/V, max.), and load regulation (0.01 %V$_o$/A, max.).

Pressure transducers: what you need when you need it —and at the right price

When it comes to pressure transduction we have the devices you need. If you're involved with hydraulic controls, medical instrumentation, machine monitoring, flow control, chemical analysis, etc, in the industrial, automotive, medical, or process control fields—among others—remember this: Our unique transduction method, our manufacturing skills, and our *in-touch* application-oriented designs combine to guarantee you production volumes of the most advanced, reliable, and cost-effective true IC pressure transducers you can buy.

Four years ago we published the first transducer catalog of any usefulness to transducer users. Since then, National has become a world leader in the field. Now we've made this experience available to you in an up-to-date new edition of that catalog. The 142-page mix of detailed specifications and charts and tables, and applications-oriented hard-to-come-by practical information—and some blue sky thoughts, too—is so complete and useful that we call it *The Pressure Transducer Handbook*.

Besides completely characterizing our extensive line of pressure transducers and telling how to install them, the *Handbook* has sections on accuracy, auto-referencing, and signal conditioning; on packaging and environmental considerations; fluid flow; accelerometers and load cells; switch control; temperature measurement; and medical, acoustic, and automotive applications.

From theory to practice, from the here-and-now to the avant-garde—it's all between the covers of *The Pressure Transducer Handbook*. A copy is yours for $3.00.

APPLICATIONS CORNER

Seven-segment to BCD—the easy way

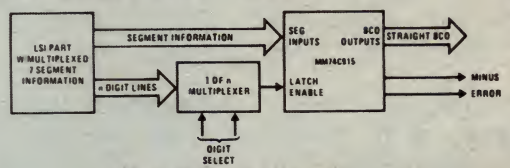
Many popular devices output multiplexed seven-segment information. If you want to analyze such information, or store it, process it or route it, it is more efficient and easier to do if you first convert to a BCD format. Unfortunately, most of the articles that have appeared on this subject in the trade press have presented methods that are expensive, or complicated, or both. Unfortunately, too, the interface problem has aggravated the situation. Thus, the use of calculators, clocks, counters, and ADs as number crunchers, real-time clocks, and inexpensive converters has been discouraged. But now, we're pleased to point out, the situation has changed.

It has changed because of our MM74C915—a CMOS seven-segment-to-BCD converter. This part holds, on one chip, all the circuitry you'll need for level shifting, decoding, latching, busing, and even error detection.

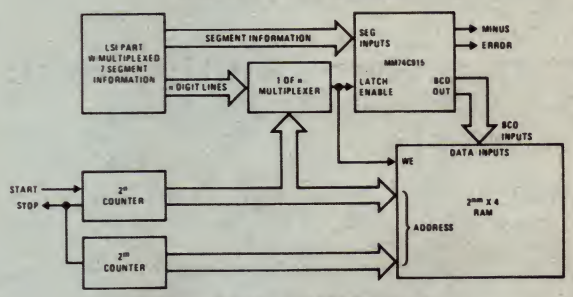
The MM74C915 accepts either positive-true or negative-true inputs. It decodes only legitimate seven-segment characters, allows for variations on the characters one, six, and nine, and gives you an error output when illegitimate characters are present. Its on-chip latch simplifies de-multiplexing a display; the outputs are TTL compatible; and the inputs are MOS compatible without a clamp diode to V_{CC}. And you can use the Tri-State® data outputs for direct data-bus interfacing; there's even a minus-sign output useful in program branching.

With a single MM74C915 you can interface a nine-volt calculator or a watch chip to a five-volt MPU; you can store data in half the memory space, route it with a mux half as wide, process and analyze it twice as efficiently—all without the loss of the price or low parts count of a MOS seven-segment device.

In fact, it's so easy to use and solves so many problems that whenever you think of the seven-segment LSI world, you should also think about the MM74C915.



Multiplex 7-Segement to Straight BCD



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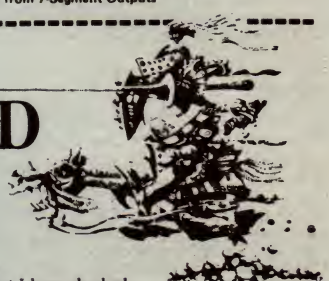

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At last a computer for those who know NOTHING about computers!

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Later this month, Tandy Electronics is releasing its new TRS-80 microcomputer in Australia. Designed especially for use in the home, small business and school, and by people with no previous experience, the TRS-80 is a complete computer system offering facilities until now found only in systems costing around $15-20,000 — yet it will be selling for only $799.95. A few weeks ago EA's Editor Jim Rowe was invited by Tandy to review the first sample TRS-80 system brought to Australia, and here is his report:

When Tandy Electronics invited me to review the advance sample of the Australian version of their TRS-80 microcomputer system, I was naturally very interested. Like most microcomputer enthusiasts I had already read about the TRS-80, which created quite a stir in the USA when it was released there in August last year.

Of course the TRS-80 was not the first small computer system to appear. Hobby-type computers have been available for a couple of years now, thanks to the development of large-scale integrated circuits (LSIs) like the microprocessor — which squeezes all of the circuitry of a digital computer's "central processor unit" or CPU into a single tiny chip of silicon.

But hobby computers have generally been sold as do-it-yourself kits, and often for individual parts of a computer rather than for a complete system. Not only that, but the literature and program "software" supplied with hobby computer systems is often quite sparse, and suitable only for people having considerable experience with computers. Needless to say, this makes hobby computers mainly of interest to the mad keen amateur and off-duty professional.

In the meantime for a much wider group of potential users like school students and teachers, small businesses, and self-employed people like doctors, solicitors and plumbers the only small computers which were suitable for their needs were too expensive. At around $20,000 they have been beyond most small businesses and self-employed people, while even the schools have only been able to afford a few, generally purchased by state education departments and "passed around" for a few days at a time between individual schools.

But the TRS-80 and other small low-cost microcomputer systems now starting to appear on the market are going to change all this. For the first time since computers were developed in the late 1940's, almost anyone who needs a computer is going to be able to buy

Low in cost, Tandy's TRS-80 microcomputer is ideal for small businesses, schools, and budget balancing.

A closeup of the complete TRS-80 system. The computer itself is inside the keyboard unit; the TV monitor and cassette recorder are quite conventional. As you can see, there are no highly technical controls.

one and learn to use it themselves to solve their own problems.

I don't think it is exaggerating to say that the TRS-80 is the first of a new breed of "personal" computers, which are already starting to work the real computer revolution. No longer will computers remain the impersonal, limited-use machines restricted by their high cost to the world of big business and huge corporations. From now on their benefits are going to flow directly into the "grassroots" level of our society, with machines of various sizes used personally and as an everyday tool by anyone who can benefit from them.

But enough of this general introduction. Having looked briefly at the context in which the new "personal computers" have appeared, let's now take a closer look at the Tandy TRS-80 — the first of the low-cost systems to actually reach the consumer market.

Unlike many of the hobby computers, the TRS-80 comes not as a kit, but as a completely assembled as tested system which is ready to run. It comprises four units: the computer itself, built into an input keyboard unit; a high-resolution video monitor, with a 30cm-diagonal display; a cassette tape recorder, for program and data storage; and a small mains-stepdown transformer unit.

The computer unit itself measures only 425 x 208 x 90 mm, and looks just like the keyboard unit of a video terminal. However under the professional 53-key keyboard is a complete microcomputer, based on the Zilog Z-80 microprocessor. Along with the Z-80 in the basic TRS-80 computer unit are 4096 words ("4k") of dynamic read-write memory (RAM), another 4k words of read-only memory (ROM), all the circuitry required for the video display interfacing, and the cassette tape interfacing circuitry.

Resident in the ROM, and ready to spring into life as soon as power is applied to the TRS-80 is an interpreter program for "Level 1 BASIC" programming language. Without going into the technicalities, this means that the TRS-80 can be programmed in the easy-to-learn BASIC language developed at Dartmouth College in the USA, rather than in the harder-to-grasp and more tedious machine language or assembly languages used on many hobby computers.

The Level-1 BASIC offered on the TRS-80 is virtually the same as that available on much larger and more costly systems. It handles both integer and floating-point arithmetic, with a numeric range of approximately 10^{-38} to 10^{38} and a resolution of 7 digits (6 displayed) in floating-point mode. Up to 26 numeric variables may be used, together with two string variables of up to 16 characters, and a single dimensioned array. (If this doesn't mean anything to you at this stage, don't worry. Keep reading, but just skim over the next paragraph or two. . .)

If you're familiar with BASIC language commands, the TRS-80 features all the standard commands: NEW, LIST, RUN, CONT, REM, LET (optional), FOR-NEXT-STEP, GOSUB-RETURN, STOP, END, GOTO, IF-THEN, INPUT, ON-GOTO, ON-GOSUB, PRINT, DATA,READ and RESTORE. Many of these can be abbreviated, to contract program size if desired. There are also the standard mathematical functions, relational operators, logic functions and functions including INT, TAB, ABS, RND and MEM (memory size).

There are four other commands concerned with the cassette tape recorder. CSAVE is for saving programs on tape,

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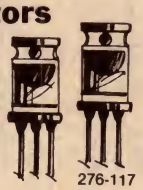

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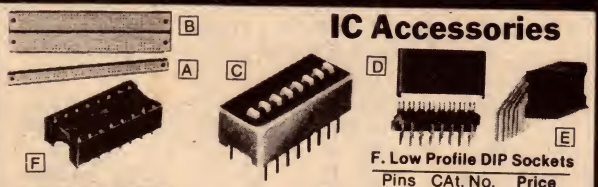

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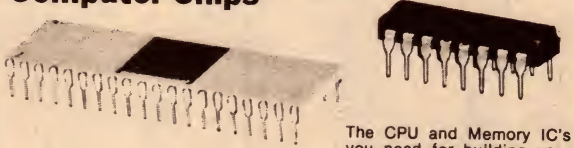

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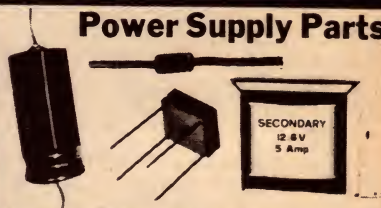

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TANDY ELECTRONICS

while CLOAD is for loading them back into the computer. Similarly INPUT and PRINT are for exchanging data between the computer and tape.

But perhaps the most exciting thing about the TRS-80 is that the video display has a graphics facility, allowing graphs, simple diagrams and other artwork to be generated on the video screen along with alphanumeric information — and all programmable in BASIC. The commands to facilitate this are CLS (clear screen), SET(X,Y) (turn on graphical element at location x, y where x has a value from 0 to 127 and y a value from 0 to 47); RESET(X,Y); POINT(X,Y) (which is a function returning a value of 1 if the point x,y is on, or 0 if it is off); and PRINT AT Z (which allows placement of alphanumeric information at any desired position on the display).

If some of the foregoing details of the BASIC commands and functions provided by the TRS-80 don't mean much to you, don't assume that the computer is only for those who already understand the jargon. Nothing could be further from the truth. In fact Tandy has assumed that a buyer of the TRS-80 won't have even heard of BASIC before, and is coming to it without any prior knowledge at all. Accordingly the system comes complete with a big fat User's Manual, written in very simple language and starting right from the beginning.

Tandy sent a proof copy of the User's Manual along with the sample TRS-80 system provided for review, and I was able to examine it at length. While only a proof I am happy to report that the manual looks excellent — well written, clear and easy to understand. In fact it is by far the best introduction to programming in BASIC that I have seen to date, and I think Tandy is to be congratulated.

It takes a very practical approach, and is intended to be read while seated in front of the TRS-80 itself. All of the concepts are illustrated in the easiest and most direct way — using simple programming examples which are fed into the machine and run immediately.

The writer of the manual, Dr. David Lien, has deliberately taken a light and breezy approach. In fact he has injected quite a bit of humour. I found the humour quite pleasant, and effective in maintaining the interest level, but some people may find it a trifle overdone.

Thanks to the manual and the straightforward "human engineered" hardware, I believe that even people with no previous knowledge of computers at all should be able to approach the TRS-80 with every confidence — even if you aren't too strong at maths. After working through the User's Manual, you'll be able to drive the TRS-80 like an expert, and be ready for almost anything!

And it's amazing just what the TRS-80 is capable of doing. Tandy itself is going to market a series of software packages (with the programs recorded on cassettes), for some of the more obvious applications: primary school maths tuition, personal finance management, games of chance, kitchen menu filing, scientific and engineering calculations, music theory tuition, general ledger, and inventory control. But there's almost no limit to the programs you can write yourself, to take advantage of the TRS-80's considerable facilities.

Of course, being a relatively small machine, the basic "4k" version of the TRS-80 has its limitations. With this in mind Tandy will soon be offering an expanded "16k" version, with four times the memory capacity and an enhanced "LEVEL 2 BASIC" interpreter. The larger version will be able to interface to further peripherals, too — like a printer, a floppy disc drive and similar devices. So the basic TRS-80 system will be expandable into as large a system as you may need, as your experience and ambition grows.

The 30cm video monitor supplied as part of the TRS-80 system is fully solid state, and has a bandwidth of more than 6MHz for crisp, sharp displays. The incoming video signal is isolated from the cathode ray tube circuitry via an opto-coupler, to ensure that the computer cannot be damaged by arc-overs within the tube. The monitor is a standard video monitor, and has a 75-ohm input; it can be used not only with the TRS-80 but with any source of of standard video signals. The TRS-80 video interface is built into the computer unit itself, and only standard composite video passes out to the monitor. Other monitors may thus be used, although they must have high bandwidth for adequate resolution.

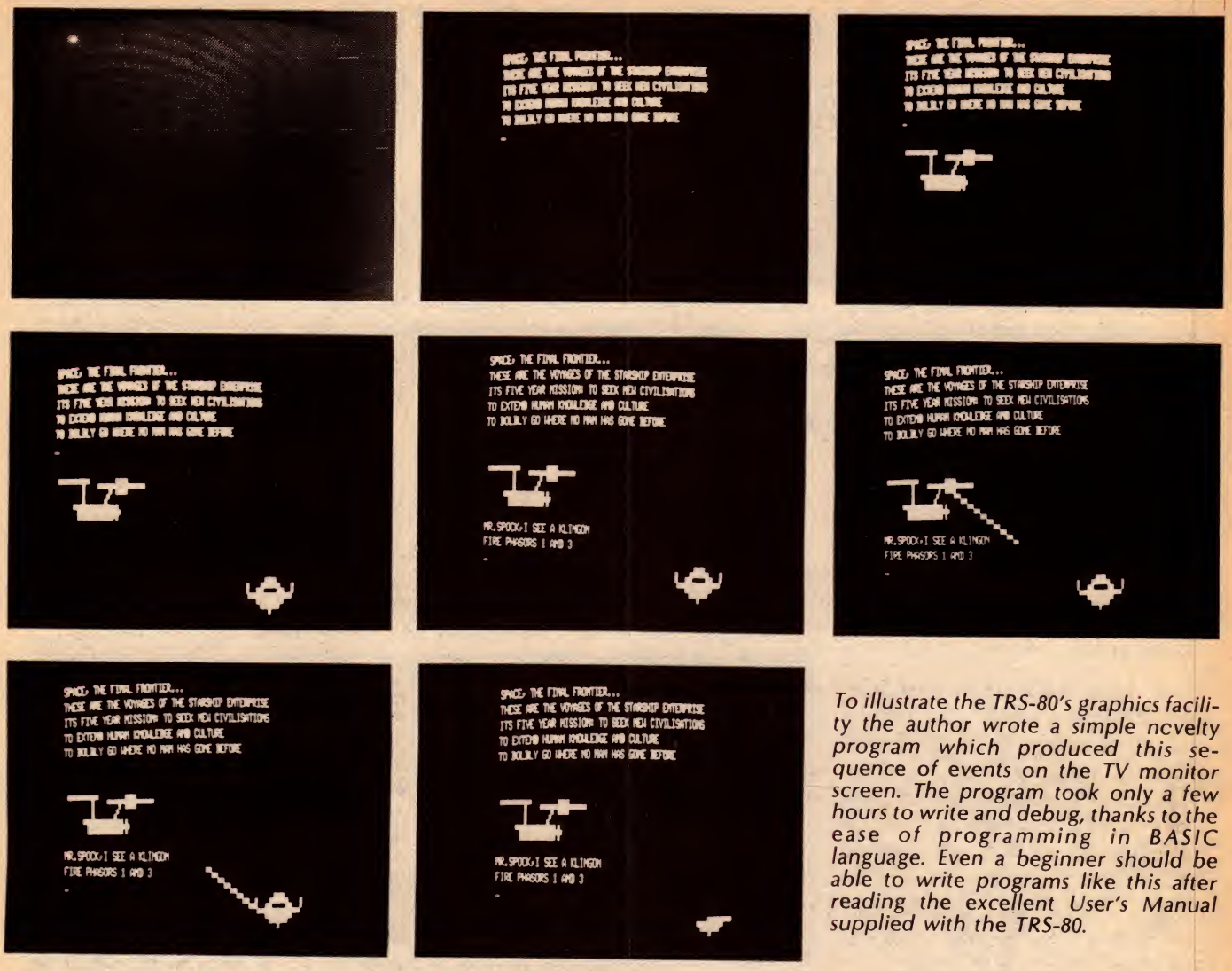
Similarly the cassette recorder which forms part of the TRS-80 system is a standard audio recorder. The computer unit controls it semi-automatically, via an inbuilt relay which connects to the "remote" jack on the recorder. The user must perform the remaining tape functions manually, like rewinding and ensuring that the recorder is in play mode before a CLOAD command, and in record mode before a CSAVE command.

The cassette recording method used involves pulses, and is self clocking. The data rate is approximately 300 baud.

Tandy Electronics sent the sample TRS-80 system to my home, and as a result I was able to spend quite a bit of time both examining it and putting it through its paces. It soon became evi-

As a result of its low cost, ease of programming and graphics facility, the TRS-80 is well suited for use in both primary and secondary schools.

A computer for those who know NOTHING about computers . . .



To illustrate the TRS-80's graphics facility the author wrote a simple novelty program which produced this sequence of events on the TV monitor screen. The program took only a few hours to write and debug, thanks to the ease of programming in BASIC language. Even a beginner should be able to write programs like this after reading the excellent User's Manual supplied with the TRS-80.

dent that a great deal of care and thought has gone into the system, to make it not only an impressive performer but one which is both businesslike and foolproof, as well.

Just about everything is software controlled, from the keyboard, which makes for a simple and straightforward operation. There are no confusing or technical controls; in fact the only two controls visible are the contrast and brightness knobs on the video monitor, and the control buttons on the cassette recorder.

When power is applied, the computer tells you that it is READY on the monitor. You then proceed to tell it what to do, via the keyboard, in BASIC language. If you type something it doesn't understand, it responds with an understandable WHAT? Or if it understands the command, but the command cannot be performed for some reason (generally because you have asked it to do something impossible, or haven't supplied all the information), it responds with HOW? And if your program is so long that it has filled up the available memory space, it displays an apologetic SORRY!

There are no cryptic signs or symbols, no elaborate technical procedures, and no mysterious error codes. Just these easy to follow messages, straightforward and businesslike.

In very short order I found myself writing — and running — all sorts of intriguing little programs, including a "fun" graphics program in which a tiny "Star Trek" space ship appears on the video screen, and fires its phasor beams to destroy a "Klingon" vessel! Thanks to the TRS-80's BASIC commands for graphics, I had this going in a few short hours.

To summarise, then, I found the Tandy TRS-80 a delight to use. It seems to me to have been very carefully engineered in terms of both hardware and software, and its accompanying User's Manual is excellent. In every respect the TRS-80 seems ideal for both beginner and experienced computer user alike, and I predict a big future for it in small businesses, offices, schools, workshops and homes. It is literally a "computer for the masses" — even those who may regard themselves as "hopeless" at maths!

The introductory price of the complete "4k" TRS-80 computer system, including computer unit, video monitor, cassette recorder, stepdown transformer and User's Manual is $799.95. The 4k computer unit and stepdown transformer also will be available separately, for $569.95. The video monitor will also be available separately, at $229.95. and the cassette recorder at $59.95. For those who want the larger "16k" computer unit, this will be available for $980.00

Tandy will also be selling programming and graphics coding sheets, in packs of 50 and 25 respectively. Full servicing facilities will be available.

If you're interested in the TRS-80, you can get further information on it from your nearest Tandy Electronics store. Or you can contact Tandy's national marketing manager for their microcomputers, Mr Ken Allen; you can telephone him in Sydney on (02) 638-6633. But I suggest you don't delay — judging by the response that the TRS-80 received in the USA, initial stocks aren't likely to last long.

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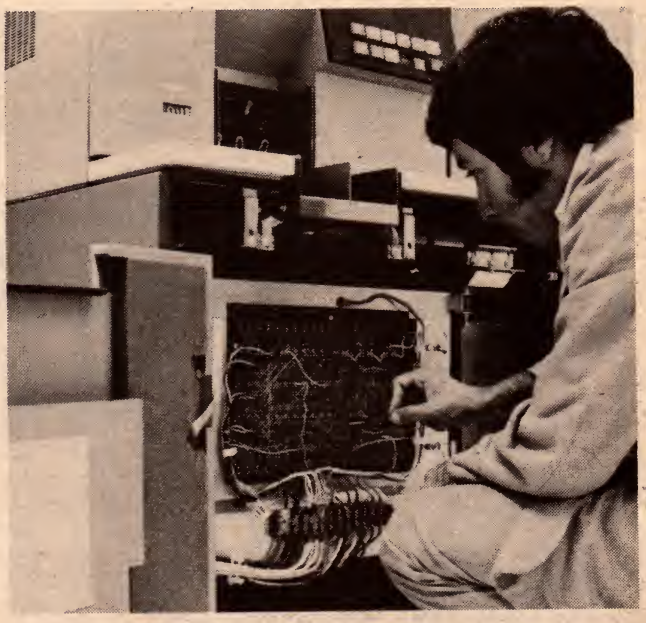

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Meteorites have the potential to tell us much about the history of the universe. This article explains how scientists are able to unlock the secrets contained in meteorites, and lists some of the things that we have learnt — by Brian Dance, M.Sc.

Meteorites: what they can tell us

Meteorites are irradiated for very long periods of time by cosmic radiation as they travel through the solar system. When a meteorite enters the Earth's atmosphere, its outer surface is raised in temperature to a brilliant white heat so that it is seen as a "shooting star". Smaller meteorites are completely disintegrated in the atmosphere, but the core of the larger meteorites can reach the surface of the Earth.

Experiments with this meteoritic material can provide information on the radiation history of the meteorite. This in turn furnishes information on cosmic radiation, and on the development of the solar system.

During the past few years equipment has been set up which can photograph the tracks of meteorites passing through the atmosphere. Such observations help to find fallen meteorites quickly, making it possible to measure the amounts of some fairly short-lived radioisotopes in them which are formed by cosmic ray bombardment!

In addition, photographic observations enable the orbit of a meteorite to be computed with reasonable accuracy. One can then correlate the radiation dose estimated from experimental work on the meteoritic material with the cosmic ray intensity at various points in the orbit.

Meteoritic material can be divided into two main types — iron meteorites and stony meteorites. Iron meteorites contain mainly iron and nickel, whereas stony meteorites contain a large proportion of silicates with some iron and nickel. Some stony meteorites, known as "chondrites" contain spherical regions of iron-magnesium silicate called "chondrules". Stony-iron meteorites have a composition intermediate between that of stony and iron meteorites, but are less common than the other two main types.

Early chemical investigations of meteoritic materials indicated that they were formed in large parent bodies which were so hot that the iron melted and accumulated at the centre. The collision of two or more such bodies would produce fragments which could circulate in the solar system for millions of years before reaching the atmosphere of the Earth.

The central iron zone forms the iron meteorites, whilst the structure of the stony meteorites is consistent with their formation on the outer parts of the parental bodies. The crystal structure of iron meteorites provides information on the rate of cooling of the parent bodies, which is of the order of a few degrees Centigrade per million years. This indicates that the parent bodies had a radius of the order of 100km.

Considerable efforts have been made to estimate the date of formation of the parent bodies of the meteorites, and the dates at which these various parent bodies disintegrated into individual meteorites. If one assumes that the parent bodies were very hot, it seems that the heat could have come only from radioisotopes contained within the bodies. The natural radioisotopes found on Earth (uranium-238, thorium-232 etc.) have such a long half-life that their rate of decay is far too slow to raise the temperature of the parent body to the melting point of iron.

Shorter lived materials such as aluminium-26 (half-life about 750,000

The Willamette Meteorite is the largest meteorite ever found in the US. Rust and atmospheric friction pitted one side of the meteorite, which was unearthed in 1902 and weighs 15½ tonnes.

A giant meteor crater near Winslow, Arizona. This one measures just over 1.2km across, and is around 175 metres deep. Scientists believe that the crater was formed about 50,000 years ago. The meteorite exploded on impact. (Fox Photos, USA).

years) are thought to be responsible for the heating of the parent bodies. This implies that the parent bodies must have formed soon after the elements of the solar system were first formed, otherwise the shorter lived radioactive materials would have decayed away. Other experimental evidence supports this early formation theory (within a few million years of the creation of the elements). Thus, if we can estimate the date at which the parent bodies were formed, we will also be able to estimate the time of formation of the elements (to within about 10 million years).

Some early experiments on the dating of meteorites involved the same uranium-helium dating techniques as have been used for work on terrestrial rocks. As uranium undergoes radioactive decay, helium gas is liberated. If the material is cool enough to retain this gas, the amount of helium increases with time.

Some of the meteoritic ages found by estimating the uranium/helium ratio were too low owing to the loss of helium. In other samples, however, the production of additional helium as a result of bombardment of the meteorite by cosmic radiation resulted in ages being obtained which were too high (greater than the normally accepted age of the universe). Nevertheless, this work has indicated that the helium formed from uranium ceased to escape easily from the parent bodies some 4,500 million years ago.

In the regions outside the atmosphere cosmic rays consist of very high energy particles (mainly protons). The range of energy is very wide, but the average energy is a few GeV. When such a high energy particle strikes the nucleus of an atom in a meteorite, various particles are emitted and a new atom is formed. This process is known as "spallation" and the new atom is called a "spallation product".

The high energy particles of cosmic radiation cannot penetrate deeply into the parent bodies from which meteorites are formed. However, when the parent body breaks up into individual meteorites, the amount of the spallation products formed by cosmic ray bombardment accumulates with the passage of time. The concentration of spallation products (both stable and radioactive) in the meteoritic material can be estimated, but in order to estimate the time for which the material has been exposed to cosmic ray bombardment, one needs to know the rate of formation of the spallation products.

It is not easy to estimate this rate of formation since it depends on the composition of the meteorite and on the intensity and energy distribution of cosmic rays to which it was exposed.

A better method involves estimating the concentration of two different spallation products of about the same mass number, only one of which is radioactive. If the half-life of the radioactive material is not too long, its concentration increases until it is decaying away as rapidly as it is being produced. The concentration of the radionuclide then remains constant, whilst the concentration of the stable nuclide increases with time. Thus the ratio of the concentration of the two spallation products can be used as a measure of the time for which the material has been exposed to cosmic radiation.

In general, the times for which stony meteorites have been exposed to cosmic radiation (as estimated by this technique) are about fifty times shorter than the corresponding times for iron meteorites. Various possible explanations for this difference have been suggested.

For example, if stony meteorites are eroded in space more rapidly than iron meteorites, the stony meteorites which do not reach the Earth within a certain time would become too small to pass intact through the Earth's atmosphere. However further work on the problem of the relatively short ages of stony meteorites is required.

Some iron meteorites show exposure ages of over 1,000 million years, but most have exposure ages ranging from

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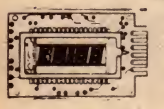

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Meteorites: what they can tell us . . .

200 to 950 million years. Stony meteorites, on the other hand, generally have ages under 25 million years.

Another technique used for the investigation of radiation history of meteorites is thermoluminescence. The radiation dose received by meteoritic material from cosmic radiation and from the natural radioisotopes it contains raises a small proportion of the electrons or holes in the material into various trap levels.

If the material is placed on a metal heating strip and its temperature is raised at a constant rate in an inert gas, the electrons or holes are released from their traps at various temperatures with the emission of a very small amount of light. This light is detected by a photomultiplier tube and its intensity automatically plotted against the temperature. The area under the resulting curve is a measure of the radiation dose received by the material.

It should be noted that the thermal conductivity of meteoritic material is generally quite low. The electrons and holes on the outside surface of the meteorite are released by heating as it passes through the atmosphere, but the material a short distance inside the crust remains quite cold. Samples are therefore taken a few centimetres from the crust.

The weight of the powdered meteorite used in each thermoluminescence experiment is only a few milligrams. Similar samples of meteoritic powder are given large known doses of radiation (often in the range 100krad to 3Mrad), and the light emitted from this artificially irradiated powder as the temperature is raised measured in the manner described above. Experiments of this type enable an estimate to be obtained of the amount of natural radiation which the meteorite has received before it reaches the Earth.

It has, for example, been shown that a gamma dose of about 300krad must be given to powdered Allende meteorite to produce a similar amount of thermoluminescent glow to that obtained from the natural material.

It is important to avoid using the low temperature glow for these measurements, since the low energy traps which give rise to this glow are gradually emptied over the long period of time for which a meteorite is irradiated in space.

If one measures the dose received by a meteorite and one can estimate the dose rate, one can obtain a value for the time over which the dose has been received. Unfortunately various difficulties arise in this procedure.

It appears that a given dose of cosmic radiation is less efficient in inducing thermoluminescence than the same dose of beta or gamma radiation. Experiments are being conducted to measure this efficiency using large accelerators. One can estimate the dose received from the natural radioisotopes present in the meteoritic material fairly accurately, although one must allow for the lower efficiency of alpha radiation in producing thermoluminescence. However, it is difficult to estimate the dose rate from cosmic radiation, since this depends on the orbit of the meteorite and the amount of shielding around the specimen.

One can place an upper limit on the age of a meteorite by considering only the radiation dose rate produced by the internal radioactivity of the specimen. This age limit is the actual age only if the shielding around the specimen before it entered the atmosphere was great enough to reduce the cosmic ray dose rate to a value much smaller than that due to the internal natural radioisotopes. Ages of the order of a few million to a few tens of million years are obtained if one neglects cosmic ray dose rates.

Such ages correspond to the accumulation of thermoluminescence from the time of break up of the parent bodies, rather than from the time at which these bodies became cool enough for the traps in the material to be kept full.

Thus it appears that the mechanical shock generated at the time of collision of the parent bodies destroys the accumulated thermoluminescence. This theory is backed by experimental evidence, obtained in the laboratory, that mechanical shock can release trapped charge carriers.

The loss of low temperature thermoluminescence in a meteorite will depend on the past temperature of the material. The thermoluminescence technique can thus be used, at least in principle, to estimate the past temperature of the meteorite.

When an energetic charged particle passes through a solid dielectric, it leaves a track which can be etched. The etched tracks can be seen under a microscope. In meteorites, only the heavy cosmic ray particles produce etchable tracks, but the picture is complicated by the presence of other tracks, such as those caused by fission fragments from the natural radioactivity in the material.

Nevertheless, the analysis of particle tracks in meteorites has been used to determine the shape of a meteorite before it entered the atmosphere of the Earth. This is possible because the cosmic ray track density decreases with

distance from the outer surface of the original meteorite.

There is a critical temperature for each type of crystal in meteoritic material below which etchable tracks can be formed; this temperature can be measured in the laboratory. Thus if one examines two different types of crystal in a meteorite having different critical temperatures, the one having the higher critical temperature will have the higher track density. The difference in track density is a measure of the rate of cooling of the parent body between the two temperatures.

The length of a cosmic ray particle track is dependent on the nuclear charge of the particle. One can therefore estimate the proportions of the various nuclei present in cosmic radiation by measuring the lengths of the particle tracks. Experimental evidence indicates that the composition of cosmic radiation has remained fairly constant over a period exceeding 10 million years.

Many tracks due to the spontaneous fission of plutonium-244 (half-life 80 million years) have been found in meteorites. This shows that the parent bodies must have formed and cooled below the critical temperature for track formation within a period of a few hundred million years. The concentration of tracks from this isotope would otherwise have been quite small.

If any of the "superheavy" nuclei of atomic number in the region of 112 are formed by the cosmic radiation, one may be able to find evidence of their tracks in meteoritic material. Some tracks which may have been made by such nuclei have been found, but we still await definite proof of the origin of these tracks. The existence of such nuclei having "magic numbers" of nucleons would be of great interest to physicists.

Note: "magic numbers" are certain numbers (eg. 2, 8, 20, 50, 82 and 126) of protons or neutrons in an atomic nucleus which result in enhanced stability for a series of isotopes of an element.

Finally we will consider an important method for the dating of meteoritic and other rocks, which is a modification of the potassium-argon dating technique. Natural potassium contains about 0.011% of the radioactive isotope potassium-40, which has a half life of 1.3 x 10^9 years. About 10.5% of potassium-40 decays by electron capture to the isotope argon-40.

After a rock has solidified, argon-40 accumulates. The ratio of the amount of this isotope to that of potassium-40 is thus a measure of the time which has elapsed since the rock solidified. One gram of a sample containing 1% of natural potassium will produce only 4 x 10^{-8} cm^3 of argon measured at NTP (normal temperature and pressure) in one million years, so special techniques are required for its measurement.

If the sample is irradiated with a very high flux of fast neutrons in a suitable nuclear reactor, a small fraction of the potassium-39 in the sample is converted into argon-39. The concentration of argon-39 (from which the concentration of potassium-40 is found) is determined simultaneously with the concentration of argon-40 derived from the long term decay of potassium-40. Mass spectrometric analysis of the gas is employed.

One of the advantages of the argon-40/argon-39 dating technique is that it permits some information to be obtained on the relative distribution of potassium and of argon-40 derived from its decay. If the sample which has been irradiated with fast neutrons is heated in stages to release the argon isotopes, the ratio of the amounts of argon-40 to argon-39 may not stay constant as the temperature is changed.

For example, in a rock which has lost some of its argon-40, one may expect the initial samples of gas released on heating to contain a relatively small amount of argon-40. The argon-40/argon-39 ratio in the gas released at higher temperatures may correspond more closely with the "actual" age of the rock. In some cases the stepwise heating technique can provide insight into the thermal history of a rock sample.

So you can see that while meteorites contain a great deal of information, this information can be quite difficult to extract. The availability in recent years of lunar material, where the orbit is accurately known and where there is no cosmic ray shielding, will provide us with a great deal of new information.

Russian scientists found tiny diamonds in a piece from this meteorite, discovered in 1961 on the Nullarbor Plain. The piece was sent to the USSR as part of a regular scientific exchange. (Photo West Australian Newspapers).

Local electronics company set for further growth

The A&R story

Towards the end of 1977, staff writer Leo Simpson was invited to visit the A&R Electronics plant in Box Hill, Victoria. His visit coincided with the initial production run of the new A&R DMM-10 digital multimeter, which represents a bold step forward for this long-established Australian company.

by LEO SIMPSON

In recent years many Australian electronics companies have struck heavy going in the difficult economic conditions. Some have ceased operations altogether while others, it seems, have prospered in spite of adversity. A prime example of the latter is A&R Electronic Equipment Company Pty Ltd, now entering its 31st year of operation. With annual sales of over $5 million and equally healthy profit figures, A&R Electronics is well set up to face the future.

As with most electronics companies of Australian or foreign origin, A&R had small beginnings. In 1947, they started in the disused laundry of the old St. George hotel in Melbourne. Total staff was seven persons.

Principals of the new company were D. K. Anderson, an electrical engineer and present managing director, and another, A. Roudi. Actually, two company names were registered in 1947, A&R Electronic Equipment Company Pty Ltd and A&R Transformers Pty Ltd. This demonstrated considerable foresight on the part of the principals, as the word "electronics" was certainly not in vogue at this time — nor would it be for some time.

The major activity in the early days was transformer manufacturing, and it continued to be so for many years. After about three years in their original location, A&R moved to premises in 378 St Kilda Road Melbourne. There they stayed for about ten years, eventually expanding to the point where they occupied five levels.

Then, in 1961, A&R moved to new freehold premises at 46 Lexton Road, Box Hill — which is the site of their present electronic equipment factory. Since then, two other premises have been aquired in Lexton Road to accommodate continuing expansion.

In 1963, an associated company, Soanar Electronics Pty Ltd, was established to import and distribute a wide range of components such as capacitors and resistors. At the time there was considerable expansion in the Australian electronics industry, so the new venture was off to a flying start.

Since its inception in 1963, Soanar has experienced strong growth and has been an important contributor to total revenue. However, recent cutbacks in the colour television industry have made the going more difficult.

The next turning point in the A&R Electronics story was the year 1973. At this time, sharp rises in labour costs and the across-the-board tariff cuts forced a drastic re-appraisal of the whole operation. Two decisions were made. The first was to introduce and promote a range of proprietry brand products to the domestic consumer marketplace.

Prior to 1973, A&R Electronics had been heavily oriented towards the manufacture of custom designed products, many marketed under well-known brands. One cogent reason for the direct entry into the consumer marketplace is that it is far more profitable than manufacturing for other marketers. As a result of this move "Arlec" brand products are now well-known throughout Australia.

The second major decision made in 1973 was to set up an "offshore" manufacturing plant. Two years later Arlec International Ltd began operations in Hong Kong. Not only did this give A&R the advantage of lower labour costs, but it gave easier access to world markets. Now, Arlec International Ltd sells in more than twenty countries.

Mr D. K. Anderson, managing director of A&R Electronic Equipment Co Pty Ltd.

A&R is certainly not alone in having to go "offshore" to make the total operation viable. Many Australian companies have been forced in this direction, with their only alternative being to cease operations altogether. A&R have found that the combination of Hong Kong plant and the marketing of products under the Arlec brand have not only ensured viability up to the present, but have helped make possible considerable expansion of the Box Hill premises. In addition, the stage has now been set for the introduction of some innovative and interesting products. More about these later.

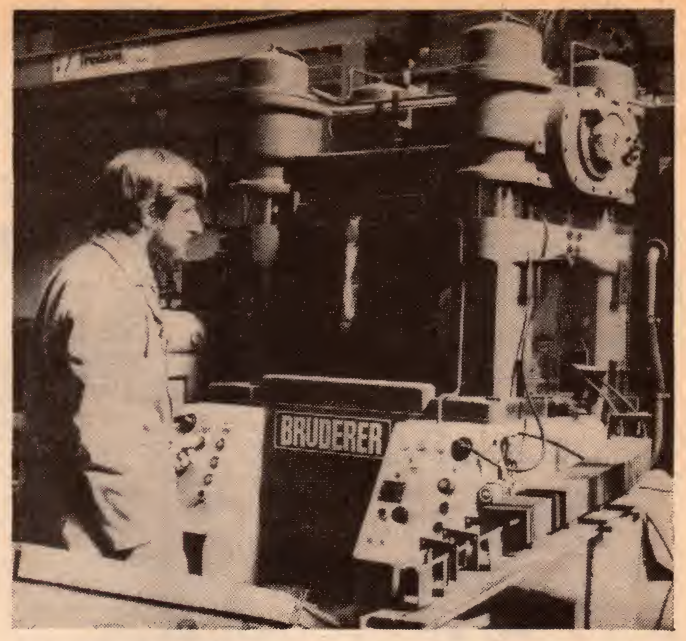
Arlec International Ltd, Hong Kong, employs about 100 people and manufactures high volume lines like the smaller Arlec battery chargers, battery eliminators and multitap transformers. However, all of these lines are also manufactured in Australia, depending on demand and production schedules.

All design work on A&R products is performed at the company headquarters at Box Hill.

Total factory employment at Box Hill (not including engineering personnel and other staff) stands at about 90 persons at the time of writing.

The photographs accompanying this article were taken while the writer toured the plant. While they provide some representative sights of the factory areas, they give no idea of the wide range of products manufactured.

Most of the products in the company's catalogue were to be seen in some stage of manufacture. These included all kinds of transformers, "plugpack" battery eliminators, battery chargers from one amp rating up to a hefty 30 amps, CB and other power supplies, light dimmers and a whole range of custom-designed equipment, some of which parallels Arlec branded lines while the remainder encompasses a surprising variety of devices.



Mr John Bedwell oversees the large Bruderer press which pours out several continuous streams of transformer laminations. (Photos in the story taken by W. F. Bryer of A&R Electronic Equipment Co Pty Ltd.)

Pictured above is the older method for winding transformers. Miss Barbara Dickson hits the button on the "stick" winder to wind 10 coils simultaneously. Meanwhile, below, Mrs Vicky Tsiganos works on the newer method with the large bobbin winder. Transformers now account for about 20% of A&R sales.

These include fan speed controllers, power supplies and controllers for toys such as electric trains and slot cars.

One of the interesting sidelights of a tour of the A&R transformer factory is the contrast between the old and new methods of manufacture. The "old" method involves the winding of many transformers on a common mandrel or "stick". This method has the disadvantage that it takes a relatively long time to set up and adjust — and while the machine is working, the operator is idle.

More efficient, although less interesting to watch is the method for winding the newer bobbin transformers which are designed to meet more stringent insulation standards. Here the machine has two mandrels, with one bobbin on each. While one bobbin is being wound, the operator is terminating or setting up the second. This means that the operator is seldom idle but has the compensation of a more manageable machine.

Another process which is intriguing to watch is that carried out by the lamination machines on bobbin-wound transformers. These machines shuffle the E and I laminations back and forth into the bobbin while the operator stands by and manually inserts insulating pieces between the growing core and bobbin, at the appropriate times. While they certainly take the drudgery out of making up transformer cores, these machines must be very tricky to adjust — the fitter or whoever does the job must have grey hair!

Also to be seen at the Box Hill plant are two pieces of equipment which help to make A&R stable and self-sufficient. The first is the large lamination press, while the second is the petrol-driven emergency power plant. The lamination press, by Bruderer, stamps out E and I laminations from continuous steel strip at the rate of up to 800 strokes per minute. This maximum rate is actually seldom used, since the streams of laminations pour out so fast that the operators cannot handle them!

Our photograph shows only the main body of the press. Not shown are the pumps, steel strip straighteners and the massive reels of steel strip. While representing a large item of capital expenditure, the press has freed the company from often-unreliable sources of supply

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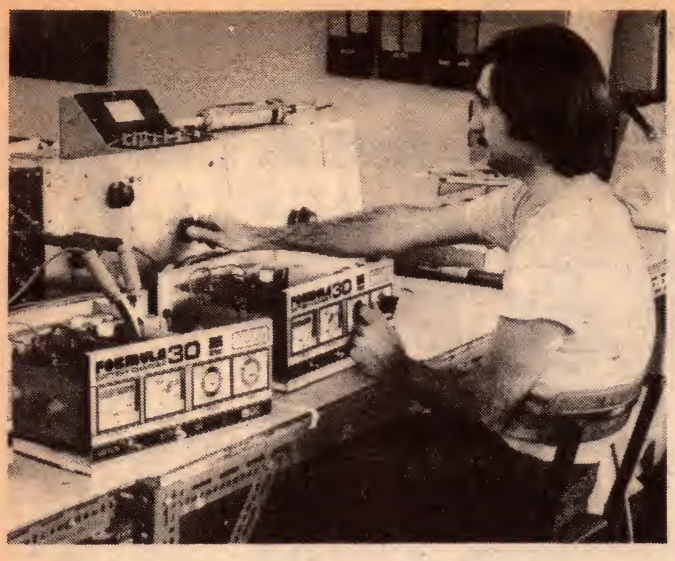
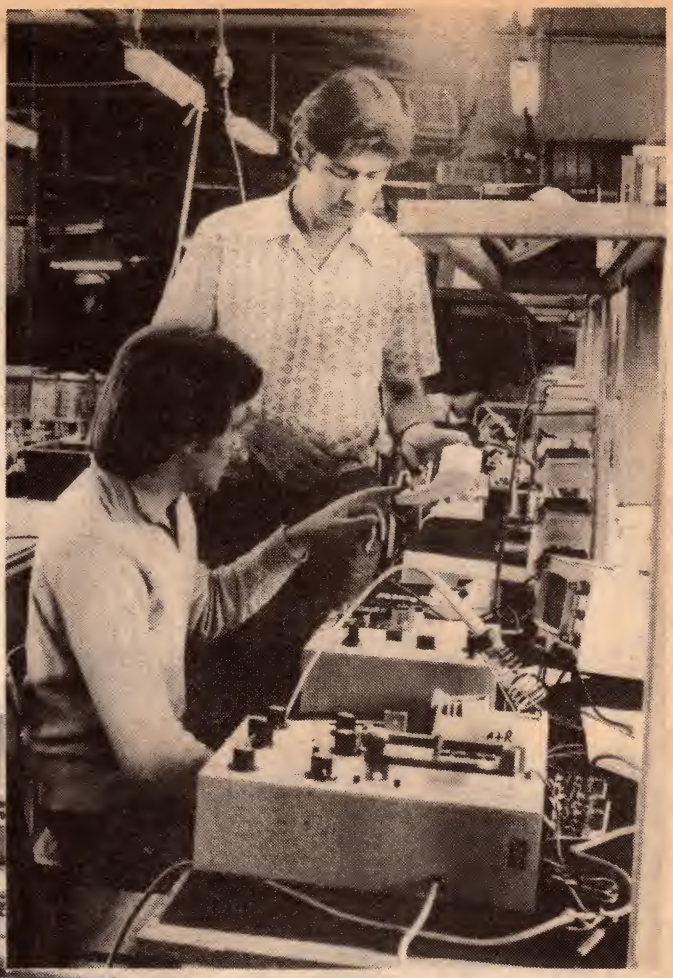


Above, Mr Colin Terns tests Formula 30 battery chargers. These are particularly robust units with protection against all sorts of abuse. Below, Mrs Betty Hamilton checks out a run of 12V/6A switch-mode power supplies which can handle input from 240V AC mains or 32V lighting supplies.

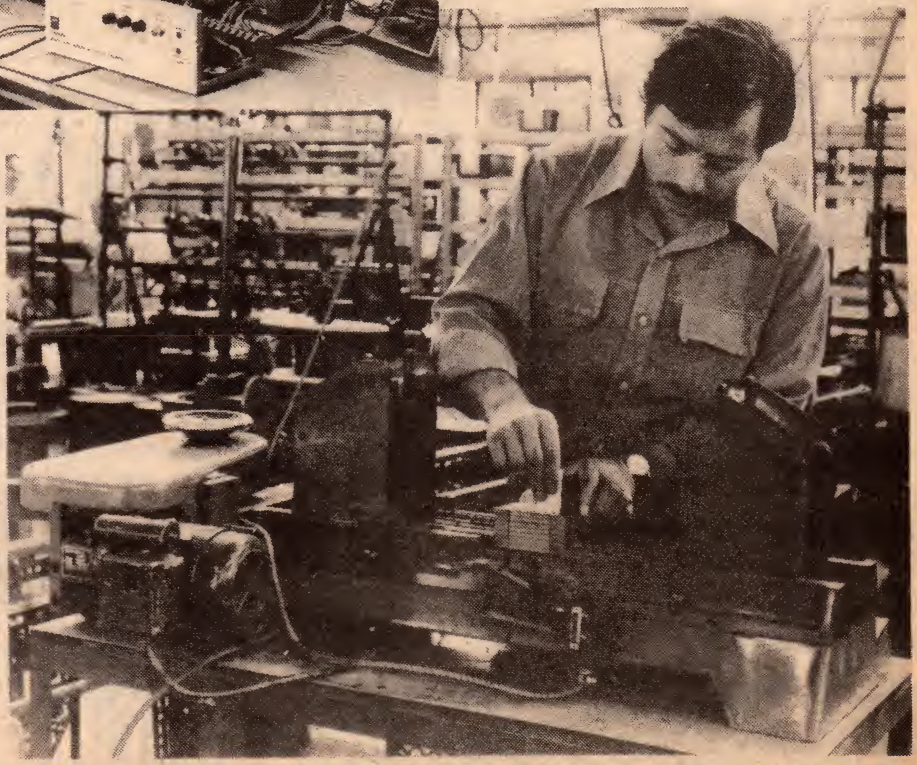


Mr Chris Sayers talks to EA staff writer Leo Simpson about the new A&R DMM-10 digital multimeter.

Equally important during the recent long and bitter Victorian power strike was the emergency power supply. While countless thousands were laid off in other industries, A&R maintained production in full swing.

But while A&R is well set up at Box Hill and in Hong Kong, for that matter, a more important facet is the attitude of its key staff. During the writer's discussions with these people in Melbourne, it became clear that while the company had once been very conservative, the decisions forced upon it in 1973 have made it more progressive and adventurous. It is now more willing to innovate and invest in product development. The results in future years should be very rewarding.

The first of some innovative products to come from A&R is their new DMM-10, a 3-digit multi-meter which is priced to sell at below $100. This is quite a challenging product for A&R, in terms of engineering and manufacturing. After all, they are about to compete with some very efficient overseas com-



Mr Theo Tsiganos inserts a piece of insulation between core and winding while the automatic lamination machine shuffles laminations into the bobbin.

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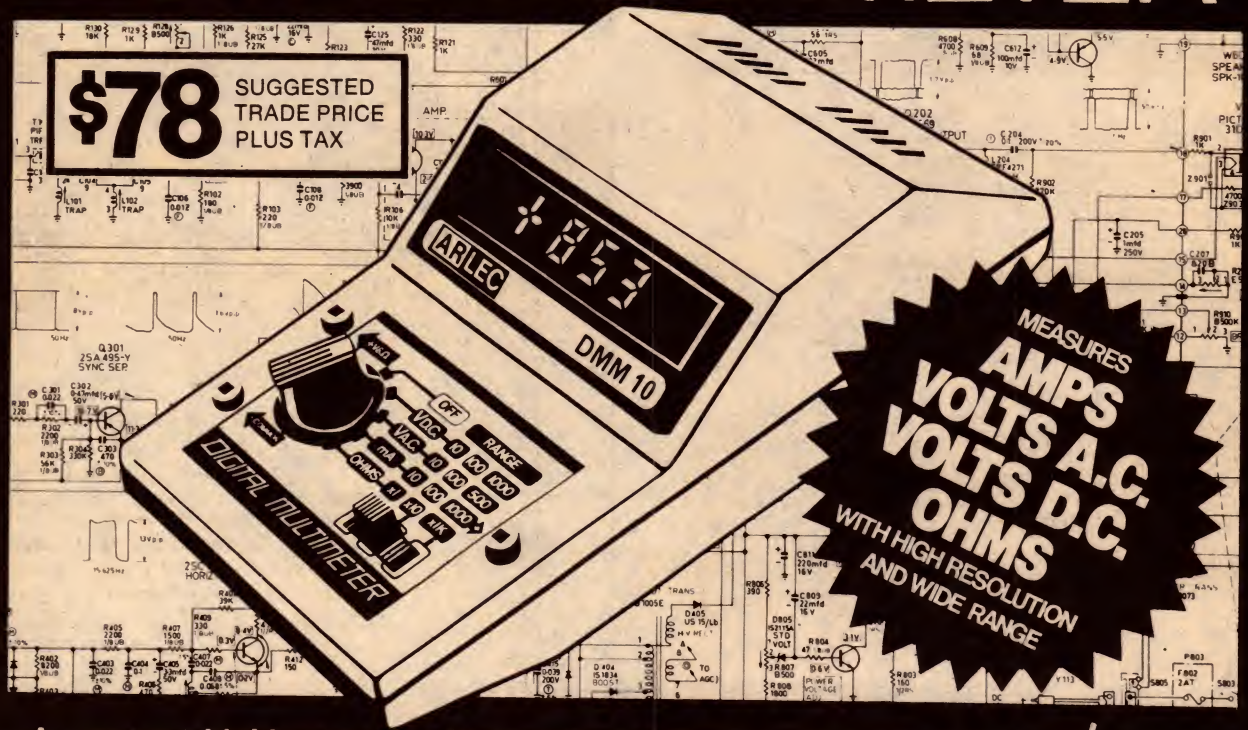

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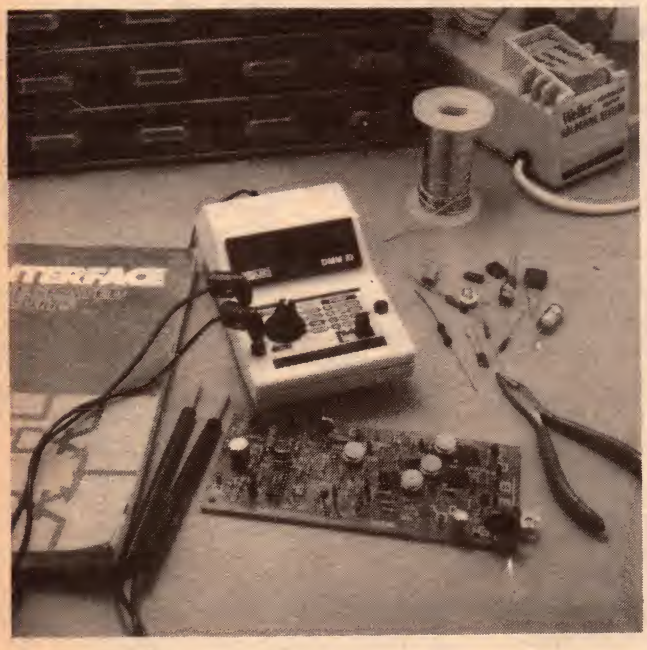
A general view of part of the A&R electronic equipment factory at Box Hill, Victoria.



At left is the new DMM-10 digital multimeter designed and manufactured in Australia. A&R hope to carve out a substantial portion of the local market for these devices.

panies. But A&R feel that they have some advantages.

The digital multimeter concept arose from a new analog-to-digit conversion process developed by an A&R engineer, Frank Bishop. Currently the subject of a patent application, the A-D conversion relies not on expensive custom-designed IC's but on readilly available devices. While apparently not quite as accurate as the precision "dual slope" A-D process, the A&R conversion method is considerably cheaper and easier to implement.

One of the side benefits of the new A&R A-D process is that it provides several constant-current sources which can be used to provide the Ohms ranges in a digital multimeter. All of which makes the process rather intriguing, but the A&R people were understandably close-mouthed about the details.

With the development of a neat and economical circuit well under way, A&R engineers turned their attention to the design of the case. The result is quite unlike any other digital multimeter on the market. For a start, the shape is most unusual and the whole device is quite colourful. The 3-digit readout is angled for easy visibility and the control panel is laid out for ease of use and good legibility.

To paraphrase the words of the chief engineer Bernie O'Shannessy, the DMM-10 is not intended as a replacement for expensive laboratory-standard digital multimeters. Rather it is aimed at the technician or serviceman who presently uses a convention-al analog multimeter. With a stated accuracy of 1%, the DMM-10 is a far more precise instrument and it will be available at a reasonable price.

A&R do not envisage manufacture of the DMM-10 in their Hong Kong plant. All the tooling has been done in Australia, even o the point where A&R have produced moulds for the little side-entry plugs (not shown in our photos) for the meter leads.

The time span from initial concept to pilot production run has been about nine months, so A&R have been moving pretty fast on this project. A&R feel that their Australia wide marketing and service facilities will ensure high acceptance of the DMM-10. It is due for release shortly.

The writer saw quite a few other products under development, although it is too early to release details. And of course, many of the existing range of Arlec products are undergoing further refinement.

All told, with a very healthy operation in Box Hill plus the Hong Kong plant, the A&R Electronics group seem well placed for strong and steady growth well into the 1980's. And that can only be good news for Australia.

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WF 529/77

Forum

Conducted by Neville Williams

THE P&T DEPT HAS BEEN AND GONE AND WENT AND DONE IT AGAIN!

Please pardon our use, in the above heading, of that very old and supposedly Australian blackstumpism but it reflects the complete frustration that I — and many others — felt at the P&T Department's recent approval of a 27MHz transceiver with a superregenerative receiver and self-excited oscillator. We just couldn't believe it!

Why raise the matter now, instead of in an earlier issue?

Well, it so happens that the event occurred at a most inopportune time in terms of our publication schedules and we would not, in any case, have been able to report it, except very belatedly. So at the time, we simply wrote it off as a story that got away! It's a familiar situation for any monthly magazine.

What's more, our January issue already carried some pointed criticism of the Government and the P & T Department for their handling of the CB situation, and we were inclined to think that enough was enough. While we're keen to see the right thing done, we're not interested in simply running crusades.

However this latest affair has really stirred the pot and renewed the protests of people who have at heart the cause of spectrum law and order. To them it provides yet another reason for people to discount and disregard the traffic rules of the ether, and it seemingly justifies their forebodings about spectrum anarchy.

Without having sought to uncover and verify every little detail, the story runs something like this:

Late last year a factory in Taiwan produced a line of very simple, very cheap CB transceivers for sale, hopefully, on the US market. Hand-held, with a telescopic antenna, they have an off-on switch, a push-to-talk switch, a combination loudspeaker/microphone and no volume control.

Internally, they provide a simple fixed tuned super-regenerative receiver and a self-excited oscillator/transmitter, pre-set on CB channel 14: 27.175 MHz in the US system. An additional "facility" is a push button intended to serve as a Morse code key. Moulded onto the case are the Morse Code symbols, along with the name "General Electric", and complete with that company's familiar script-style trademark.

Moulded on the back of the case is the FCC identification data, including the G. E. company name and emblem, the model number 3-5951C, the date of manufacture (Sept 77 in the sample we had) and the statement: "This device complies with FCC rules part 15D as of date manufactured".

Presumably, the original FCC type approval would have been influenced by the fact that they are hand-held units, with a very short antenna (42cm approx) and very low power rating. The whole thing operates from a miniature 9V transistor style battery and draws about 11mA on transmit. Total power input, therefore, is under 100mW, so that no licence to operate would be required by the user in the USA.

Reportedly, however, the FCC type approval was withdrawn.

In the meantime, the Australian General Electric Company obtained at least a provisional okay from the P&T Department to import the transceivers into Australia, on the basis of their original FCC approval. The plan was to market them in pairs under the name G. E. "Search 1" CB Walkie-Talkie, for around $25 per pair — ostensibly an attractive Christmas present, provided no one stopped to think about the $25 per set licence fee which applies in Australia irrespective of power rating!

However, when the units actually showed up on the Australian market, and came to the attention of P & T branches in the various states, they were automatically knocked back by reason of their inappropriate technical specifications. In no way could they meet the requirements of document RB249.

That really put the fat in the fire; or, if you prefer it, the cat among the pigeons!

There followed high level discussions between the importers, retailers and representatives of the P&T Department which gravitated naturally to one very practical question: who was going to carry the can for 20,000 transceivers (we heard a higher figure) imported into the country; ostensibly in good faith, and now ostensibly unsaleable?

Whatever the pressures, laments and recriminations, a directive to P & T branch offices ultimately emerged in the form of an up-date telex relative to GE 3-5951C equipment, over the signature of Mr Jim Wilkinson, First Assistant Secretary of the P & T Department. The relevant paragraphs read:

"Following a meeting between Mr Wilkinson and Australian General Electric the Department agreed to permit the licensing of the A.G.E. walkie talkie sets type 3-5951C operating on 27.125 MHz on the following conditions:

"That along with all other CB equipment which does not comply with

A pair of General Electric "Search 1" CB transceivers, which were capable of being licenced up till January 31. While very simple transceivers will not be licenced in future, we gather that "toy" transceivers like these are still to be found in clearance houses and other places. Customers are even told: "you don't need a licence".

Australian specification RB 249, no new licences will be issued on applications submitted after 1 January 1978. (It is noted, however, that licences will be granted until 1 February 1978 for sets purchased before 1 January 1978 if applications are accompanied by proof of the date of purchase).

"The company will arrange for all walkie talkies sold to be accompanied by a card or pamphlet which advises purchasers of the danger of television interference from the sets and the need to obtain a licence before the sets are operated.

"In view of the interference potential of the equipment, superintendents may consider it desirable to keep seperate records of names and addresses of licencees. In any case, please arrange for this office to be informed in due course of the total number of such licences issued your state."

As I said at the outset I — and many others — were absolutely staggered at this decision. I thought back over the many decades that this magazine, and others in the constructional field, had deliberately discouraged the home construction of super-regenerative receivers, firstly to avoid interference with broadcast band and shortwave receivers, and later with VHF TV, FM and amateur band equipment.

And, only about twelve months ago, I killed off a kit project involving a simple CB receiver because, when connected to an antenna, the super-regenerative detector blanketed the immediate vicinity with a broad band of noise.

Yet here we had thousands of super-regen. transceivers being sold as Christmas gifts with P.& T acquiescence, albeit of the red-faced variety!

How much nuisance the G.E. units may cause is not yet clear. "CB Australia" reported that, on test, the receivers would produce an audible interference within a 40 metre radius, and extending across and beyond the CB band into adjacent utility and emergency channels. I understand, from Publisher Collyn Rivers, that this observation was made in a quiet environment.

During my own observations in a typical suburban environment, with usual racket and babble going on, output from the receiver was well below the noise ambient. Neverthless, one can easily imagine situations where a group of children playing CB on a beach or bay could interfere with nearby equipment operating on the various utility channels.

One of the problems of the 3-5951C is the lack of receiver selectivity and its tendency to pick up any strong signal on any CB or nearby channel. Even if he can't communicate very effectively, the user may well let it run for lengthy periods just to hear what's going on.

It leads to another problem, in that the user has no idea from what channel a signal is being received, except in the rare case when a channel number is mentioned. He/she may therefore respond repeatedly to "CQ" calls or try to break in on conversations, completely unaware that the stations heard are using some channel other than 14.

The importers and some retailers may have made a few bucks on the sale of Search-1 transceivers but I can't imagine that the exercise will have done anything for their respective public relations images.

Quite the contrary, in fact, when their customers face the devil's multiple choice: throw the transceivers into the garbage bin; use them illegally and risk prosecution; or keep on paying $50 per year to licence two transceivers which originally cost $24.95!

But when it comes to loss of P.R. image, or technical "face", it is the P&T Department that has really suffered.

When I tried to chat "off the record" to officials with whom we have an informal relationship, one didn't need phonevision to sense their embarrassment. No, they didn't like the idea either; something had obviously gone on but they didn't know what; hopefully things might not be too bad because of the very low input power; if you want anymore information, you'd better talk to the official spokesman.

But the most anguished voice was from a field radio inspector who rang me unsolicited from interstate, primarily to commend E.A. for the contents of the January "Forum" and to say that every word in it was, lamentably, only too true. He said that many people in the Department had forseen the present difficulties and had expressed themselves accordingly, but most had now given up. Said he:

"It isn't worth it. If you open your mouth too wide, you get kicked in the guts from up top!"

"Up top", I gathered, was Canberra.

What made him particularly sour was that, a few days previously, he had drawn the regulations to the attention of a local chemist who was displaying in his window a super-regen. receiver and non-crystal transmitter — the kind of thing that was completely outside the regulations.

Then out of the blue came the clearance for a very similar G.E. transceiver.

"What kind of fool do you think I felt?"

His views were mirrored by an inspector from another state who asked the rhetorical question: "How can we, with clear conscience, knock back perfectly good 23-channel transceivers, when we've just accepted those?

Frankly, I don't know.

A spokesman for the Department is quoted as having said: The approval of the G. E. Walkie-talkies was a once-only thing and occurred through an unfortunate series of circumstances."

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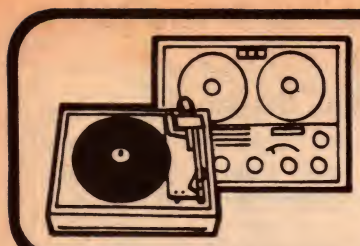

Hi Fi News

RUMINATIONS IN A ROOM: (ANECHOIC STYLE) AT MATSUSHITA

One of the rewarding aspects of my recent visit to Osaka in Japan was the opportunity it afforded to chat with Matsushita engineers working in one or other of the Company's anechoic chambers. Shut away from the noisy, outside environment, they are seeking tomorrow's answers to today's hifi problems.

by NEVILLE WILLIAMS

An audio anechoic chamber holds a unique fascination for a hifi enthusiast, being the kind of facility which he often reads about, but seldom has access to — even when he needs it! A workshop, yes; instruments, maybe; but a full scale anechoic chamber, no way!

Anechoic chambers vary in size from being something larger and higher than a domestic living room, to small auditorium size, but the true shape and dimensions are rather hard for the visitor to estimate by eye. Instead of plane surfaces, the walls and ceiling are completely covered with large, differently dimensioned wedges of sound-absorbent material, with the sharp ends all pointing inwards.

In a well appointed chamber, there are absorbent wedges underfoot as well, the "floor" on which one walks being a taut, open, steel mesh, best negotiated on sandals. As one Japanese engineer explained, this makes it a most frustrating place in which to drop a valuable pen or anything else small enough to slip through. If you can't recover it with a loop of wire or a vacuum cleaner, it just lies there between the upturned wedges, clearly visible but tantalisingly out of reach.

Needless to say, you've never seen a group of reporters more careful about the way they handled their writing implements!

The external walls are invariably thick enough to exclude outside noises, while the internal wedges absorb and break up echoes from sound generated within the chamber. Standing in front of a loudspeaker, a listener (or a microphone) hears the direct sound, uncomplicated by room echoes or extraneous noise, thereby greatly simplifying various assessments and test procedures.

Unfortunately, the sound absorption effect of the wedges tends to diminish towards the low frequency end of the spectrum and standing waves become apparent, much as in any other enclosed space. However, the chambers at Matsushita Electric, where much of the basic Technics research is done, are large enough to cope with most requirements.

Talking with the engineers in such an environment — or at least those that could speak English — one could not be quite certain how much of the work was dedicated to scheduled commercial projects, and how much was motivated by the engineers' own enthusiasm for research. One thing was certain: much of the effort was being directed, at the time of our visit towards establishing relationships between stereo and binaural methodology and between loudspeaker and headphone listening.

A vital new tool in the electro-acoustic research at Matsushita/Technics is the "bucket brigade" device ("BBD") essentially a microcircuit containing several thousand tiny storage elements, and capable of delaying an audio signal in time.

An audio signal to be processed is chopped up at a supersonic rate and each momentary segment or "sample" is fed in sequence into the input end of the bucket brigade device, through appropriate circuitry. Once in the storage chain, the samples are passed from one element to the next at the sampling or "clock" rate, to emerge finally at the output end. Here the samples are blended once again into a continuous audio signal envelope, ready to be fed to ordinary amplifier circuits.

The vital point about the process is that it takes time for a signal to be passed through the bucket brigade — a simple product of the clock period (say .05 milliseconds for a 20kHz sampling rate) times the number of storage elements involved. The delay period can be controlled precisely, either by means of the clock rate or the number of storage elements, while multiple delays can be had simply by sensing the signal as it moves along the chain. Most bucket brigade devices have tappings with this option in view.

Also important is the fact that, with good circuit practice, bucket brigade devices can delay a signal with very little deterioration in signal quality — frequency response, distortion, inter-

A study in expressions: totally unaware of the cameraman, the Australian technical press group concentrate on a demonstration in one of the anechoic chambers at Matsushita Electric in Osaka, Japan. The floor, in this case, was a framed grille of steel rods.

modulation, noise content, &c. They are therefore much more appropriate to research needs than previously available devices such as springs, acoustic plates or endless tape loops.

In one particular anechoic chamber at the Matsushita Labs, BBDs were being used in conjunction with a "Heath Robinson" set-up which looked rather like some modern day torture machine.

In the centre of the structure, and supported on pipe work, a pipe frame chair was provided for the "victim" to sit, head in a clamp, and preferably blindfolded. A semi-circle of other pipework supported a line of loudspeakers, beginning in front of him and arching over his head to the back. Another arc of speakers was supported similarly to the left and right, with a few isolated units, for good measure, at other angles.

In an outside control room were facilities for an operator to direct a signal to any loudspeaker, or any number of loudspeakers. With such a set-up it becomes a fairly easy matter to assess the ability of listeners to locate sound sources — a vital consideration for anyone concerned with the development of stereo or other such systems.

In fact, Technics engineers have been using this and other set-ups in conjunction with BBDs to assess not only

Still unaware of the ever-present cameraman, the writer listens to a demonstration of Technics "out-of-head" sound.

listeners' sense of direction but their impression of how far away the sound sources are. They have found that, by adding single or multiple synthetic echoes to a signal, the apparent source can be moved away from the listener. The very ease with which echoes can be synthesised and controlled has made it possible to determine what measures are necessary to achieve desired effects with the "average" listener.

One outcome of this kind of research is what Technics engineers have described as "ambient stereo", and I had the opportunity of listening to the result, for a brief period, in the exhibition area of the Matsushita Research Laboratories. The aim of the exercise has been to impart a greater sense of freedom and spread to domestic sound reproduction, without venturing too

BETTER PLANNING ESSENTIAL

At their recent conference in the University of Melbourne, public broadcasters from all over Australia decided to call for an inquiry into radio frequency spectrum management before the Geneva World Radio Administrative (WAR) Conference in 1979.

Such an inquiry, the Conference decided, should:

1. Review the demands for radio services;
2. Review recent technical developments which might alter the use of the radio spectrum;
3. Recommend long-term policies on spectrum use;
4. Show how long and short-term use of the radio spectrum can be balanced;
5. Declare what research could help make better use of the radio spectrum;
6. Consider the implications of the International Telecommunications Union's policy;
7. Consider the immediate needs of Australian radio broadcasters.

The public broadcasters claim that the problems to do with the long-standing shortage of AM and FM broadcast frequencies in Australia have stemmed from poor spectrum management in the past, a prime example being the 1960 Huxley Commitee's recommendation to close down the experimental FM stations and reallocate the VHF FM band.

The Conference nominated as more recent "planning disasters":

- Deviation from or non-implementation of parts of the Mclean report that brought VHF FM to Australia;
- The inability of the P & T Department to set up a satisfactory Citizens Band radio service;
- The delay in introducing UHF television channel to improve existing services and to provide for public TV broadcasting;
- The inability of the P & T Department to plan for and provide sufficient channels for the full development of AM radio.

During their conference, the public broadcasters rejected the conclusions of a report on FM frequency availability, which was prepared for the Government by the now disbanded Australian Broadcasting Control Board. The Public Broadcasting Association claims that the conclusions in this report are based on inadequate practical data. In comparison with earlier estimates — those of Sir Francis McLean and the old Media Department's "Working Party". The present report is notable for its extreme conservatism and the restrictions placed on all sectors of broadcasting.

To accept this report, the Association warns, will mean very inefficient use of a valuable public resource. The Government says that the report is the best advice it can find. Maybe it should look again!

The PBAA urges that a fresh study be undertaken on spectrum availability for both AM and FM broadcasting, with technical participation from all broadcasting sectors. The technical detail on which the decisions are being made must be documented in the study. The study should be completed and the report made available as rapidly as possible.

A PBAA technical group is to make this known to the Post & Telegraphs Department and to the new minister (Hon. Arthur Staley). It will request that the P & T Department make tests and report factually on the significance of the types of interference outlined recently by the P & T Department to the PBAA.

In accordance with the Recomendations of the Media Department Working Party Report on Public Broadcasting (1975), the P & T Department should be asked to publish, each year, an indicative plan showing possible combinations of stations serving different listening and viewing areas for each region of Australia, and their availability. This should be part of its public accountability as caretaker of a valuable public resource.

The PBAA opposes the registration of serial numbers and location of broadcasting transmitters as proposed under a new Radio Communication Bill to be placed before Parliament during 1978. The proposed legislation is designed to cover such services as the citizens band radio but could be extended to encompass any transmitting device, even a hand torch useable for sending Morse.

The Public Broadcasting Association agrees that the use of equipment should be licensed but not its possession. This is an issue of fundamental civil liberties.

The Public Broadcasting association of Australia decided to hold a technical conference early in 1978 to cover all the technical aspects of broadcasting, including operations, standards, spectrum management and radio frequency availability.

Persons desiring further information, or wishing to present papers should contact Mr Graham Wilson, Radio Station 2MBS-FM, 76 Chandos St. St. Leonards 2065.

MEANWHILE . . . . .

Father Christmas, in the form of the Australian Broadcasting Tribunal, has paid a visit to three hopeful broadcasting groups in NSW:

WOLLONGONG, on the NSW south coast is to get its second indigenous commercial AM radio station, which should be operational by the end of the year.

SYDNEY WEST, although served by existing Sydney stations is to get its own regional AM broadcast station.

KATOOMBA, on the Blue Mountains, further west of Sydney lends its name to the existing AM broadcaster 2KA, but cannot support it, even with the help of other Blue Mountain towns. It has been granted permission to instal translators near Penrith and St Marys to give it a more viable audience on Sydney's extreme western fringe.

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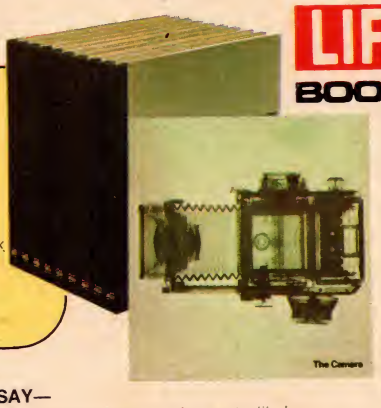

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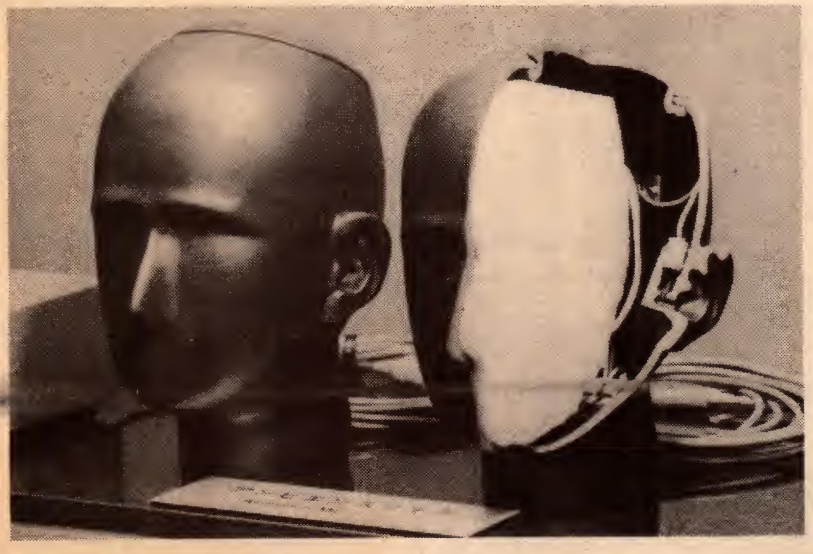
Right: In a specially arranged listening room, this array of speakers, supported on metal frames, is being used by Technics engineers to study perception of sound source direction and distance.

Below: Dummy heads, of the type used by Matsushita engineers for researching sound fields, as heard by human subjects.



far from present-day domestic stereo facilities.

At present the average domestic stereo system forms a rather rigid triangle, with the listener at the apex and the sound emerging from an acoustic "slot" joining the two loudspeakers. Ambience effects inherent in the recording tend to expand the area of the slot to a greater or lesser extent but the industry's (and listeners') dalliance with quadraphonics indicates a penchant for a less constricted sound.

Matsushita are holding their options open in regard to four-channel sound but feel that the possibilities of ordinary two-channel stereo have not yet been exhausted; hence their new ambience stereo initiative.

Without seeing more than some rather vague block diagrams, I gathered that the system employs BBD echo circuitry, along with mixing and phasing, to re-process the left and right signals from a normal stereo recording or FM broadcast. The user has an ambience or "sound image" control, which gives him/her the option of listening to the program "straight" or enlarging the sound stage and effectively moving it beyond the physical confines of the listening room.

As distinct from four-channel "surround" sound, which puts the listener in the centre of the action, ambience stereo leaves the sound source out front but increases its apparent breadth and depth.

The common touch of those working on the system is indicated by a lab. report which enthuses about the way steam trains seem to approach from a great distance on one side, blast directly in front of the listener, then fade into the remote distance on the other side. That kind of treatment would be totally inappropriate for a soloist or a chamber group but something less dramatic could be acceptable with a large orchestra!

As I mentioned briefly in the January issue, Technics engineers have been able to pull another trick with a pair of stereo loudspeakers — to achieve a most convincing binaural sensation. Members of a visiting group were invited to occupy three chairs placed along a centre line in front of the speakers. Imagine our surprise to hear a voice whispering into either ear, then from close behind the head, exactly in the now familiar binaural headphone demonstrations. There was no sensation whatever of sound coming from the loudspeakers out front.

I can imagine more relaxed ways of listening to music than sitting Indian-file down the centre of a room. I'm not sure, either, that the effect could be obtained in anything but an anechoic chamber, but I found it immensely intriguing, nevertheless.

Getting back to ordinary stereo material, it owes its "natural" spread for most programs, to the fact that the loudspeakers are normally located in front of the listening position. Whether the apparent sound images are at left, right, or centre, they are always out front, in the area which the performers usually occupy.

When one listens to the same stereo material through headphones — currently a very popular alternative — there is a fundimental change in subjective reaction. Left/right separation is exaggerated by the complete isolation of the two transducers but, more disturbingly, centre-stage sound appears to come from a point inside the listener's head.

A further problem is that headphone sound tends to be rather "dry", because reverberation in the recording is not supplemented, as intended, by additional reverberation from the listening room.

Considerable research has been carried out in the Matsushita Labs, aimed at bringing headphone listening more into line with loudspeaker listening, with ordinary stereo program material; they refer to it as "Out-of-head localisation in headphone listening".

The early research was done by purely acoustical methods. Typically, a mono signal was reproduced by a directional loudspeaker in an anechoic chamber and by a omni-directional speaker in a "live" or "ambience" chamber, the sound fields in both cases being picked up by dummy-head stereo microphones and recorded on a common multi-channel tape.

This provided the engineers with two distinct pairs of track which could be fed to observers wearing conventional headphones: (1) a virtual mono "in-head" signal from the anechoic chamber and (2) a heavily reverberated signal from the ambience chamber. By mixing the two sources it was possible to demonstrate that reverberation had

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A 4-piece stereo system comprising two speakers with a bass/midrange driver and tweeter mounted in each enclosure. Turntable and 6-band AM/FM receiver amplifier. Manufactured by the Radiotechnika Amalgamation in the USSR. (The same firm also produces Selena radio receivers which have been on sale in Australia for several years.)

The main unit features a varicap tuned FM section with three presets and an AM section with variable bandpass filters reproducing frequencies up to 2000, 4000 and 6500Hz respectively, with 47db selectivity at 10kHz detuning (on the narrow band setting). 200Hz and 5kHz filters are fitted. Separate RF front ends are provided for the 5 AM bands, a practice common in the USSR designed radio receivers.

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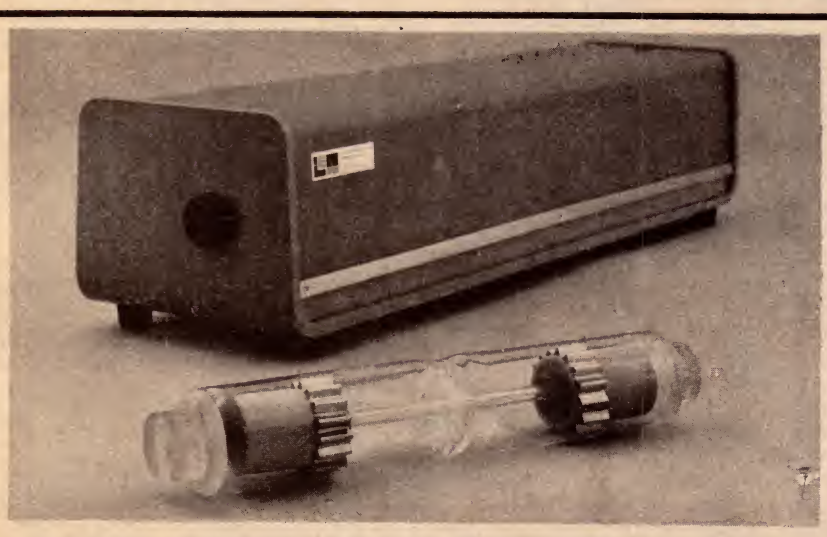

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HIFI NEWS — Continued

the effect of moving the sound sources away from the listener and progressively reducing the sound-in-head impression.

More recent research has been done with the aid of BBDs, which make it possible to add any number of echoes in any relative strength to any desired recording during the course of subjective tests, thereby increasing the apparent sound-source distance and simulating the contribution of an ambient listening room.

Additionally, some of the "left" signal can be fed to the right ear, and vice versa, slightly delayed in time because of the greater path length, exactly as happens with loudspeaker listening. In effect, the availability of BBDs has made it possible to design a "black box" coupling unit which virtually eliminates the sound-in-head reaction to stereo headphone listening, even for a mono program.

As an ultimate refinement, Matsushita engineers have also studied the effective frequency response of a "flat" loudspeaker into adjacent and opposite ears, as effected by the pinna (external ears) and the contour of a human head. Far from being flat, the subjective response, revealed by a dummy head in an anechoic chamber for a loudspeaker 30 degrees off axis, revealed a rather lumpy prominence between about 800Hz and 4kHz and a steep decline towards 10kHz.

This strongly suggests that, to simulate a natural frequency response to remote sound sources, whether from loudspeakers or live, the response of headphones clamped to the ears should not be flat but should conform, rather, to the spatial response normally imposed by the contours of the pinna and head. It could be secured, either by deliberate tailoring in the design of the phones, or by a frequency compensating network in the "black box" coupling unit, as already mentioned.

All this suggests that the qualities that are sometimes attributed to top quality headphones — brilliance, clarity, intimacy, &c — may impress in the short term but cause long-term fatigue. The requirements for relaxed, non-fatiguing headphone listening may be to aim for the remoteness, the ambience and the subjective frequency response that characterises the ordinary loudspeaker stereo — or live — "out-front" situation.

CONCEPT AUDIO PTY LTD have been appointed the Australian distributor for full range of Armstrong audio products. The present range of two tuners, two receivers and an amplifier will be supplemented almost immediately by a 25cm 3-way speaker system selling for about $700 per pair. Under develop-

ment is a 150W power amplifier.

Also due for release through Concept Audio is the Rega Planar turntable, which can be supplied with or without matching tonearm. (Details from Concept Audio Pty Ltd, 13 Rickard Rd, Narrabeen 2101.

R. H. CUNNINGHAM PTY LTD are now able to supply Sennheiser infra-red cordless stereo headphone systems for use with hifi stereo receivers and amplifiers. They were featured in the March 1977 issue of this magazine but only advance samples were available at the time.

Cunninghams also report a new development for the Sennheiser cordless phones — a 9-channel system appropriate for multi-lingual conferences. Interpreters use seperate infra-red transmitters, while delegates wear cordless phones capable of responding to any two languages, each with volume and balance control.

It is claimed that the system has important advantages over the more familiar wired inductive loop, not the least being the fact that the signal is much less prone to eavesdropping. (For details: R. H. Cunningham Pty Ltd, P. O. Box 4533, Melbourne 3001. Tel. o3 329 9633).

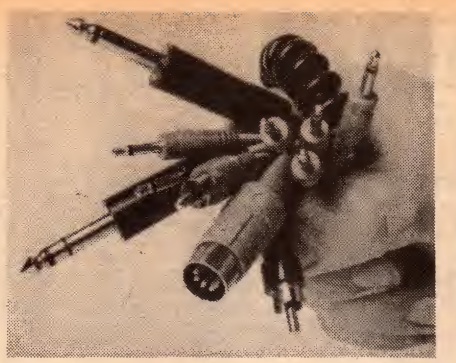
AKAI HIFI equipment will be distributed in future, in Australia, through a joint company which the Akai Electrical Company of Japan has formed with Automated Business Equipment,

Managing Director Mr Tony Paola

The Sydney based plain paper copier marketer. Well known as the distributor of the U-Bix range of machines, A.B.E. has a 60% interest in the new company. Mr Tony Paola, who founded A.B.E. in 1972, and now its Managing Director, is hoping that the new joint company will capture a 15% share of the Australian hifi market within the next two years.

SOANAR ELECTRONICS PTY LTD are now marketing a comprehensive range of quality hi-fi audio leads. 47 of the most popular configurations are available from stock including leads fitted with stereo and mono phone plugs, mini plugs and jacks, RCA plugs and in-line sockets.

The combinations available will allow the hi-fi and stereo enthusiasts to interconnect almost any type of audio amplifier system with just about any combination of cartridge and cassette



tape recorders, record players, reel-to-reel tape decks, AM and FM radio tuners, TV's etc., there are also a number of curly cord leads available for headphones, extension and guitar-to-amplifier connections.

Standard lead lengths are normally 1.8 metres but there are also extension leads and leads for particular applications up to 8 metres long.

Soanar audio leads are attractively packaged for point-of-sale display with each pack clearly marked with type no., description, and application detail. (Further information on the complete range: Soanar Electronics Pty Ltd., 30-32 Lexton Road, Box Hill Vic. 3128.)

TURNER MICROPHONES USA have announced the appointment of Audio Telex Communications Pty.Ltd. as Australian distributor for their range of professional, paging and CB microphones.

Turner, a division of Conrac Corporation, USA, have been manufacturing microphones for over 30 years. They are particularly well known for their range of high quality paging, professional and entertainment microphones, as well as their Super Sidekick CB base station microphones.

"We are delighted to be associated with Turner" said the General Manager of Audio Telex Mr. Rod Craig. "They have a fine history of microphone production and an innovative approach to the market". Mr. Craig went on, "for some time we have been considering the acquisition of a complete microphone range to compliment our very successful Bogen public address range.

Audio Telex will distribute their Turner paging line through their traditional public address outlets. (For details: Audio Telex Communications, 54 Alfred Street, Milsons Point 2061.)

Turner TC 20 multiport cardioid intended primarily for entertainment situations.

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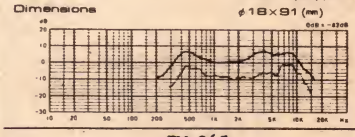
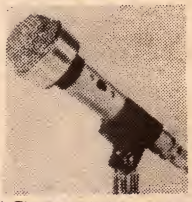
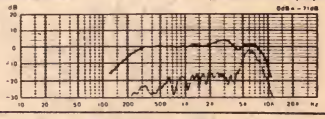


ZM 068

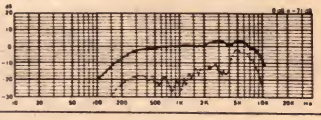


Directional Characteristics	UNI-DYNAMIC
Impedance	600·50K(Ω)(DUAL)
Frequency Response	200~9000(Hz)
Sensitivity	−71±3(dB)(600Ω)
Dimensions	φ43×142.7(mm)



ZM 069

Directional Characteristics	UNI-DYNAMIC
Impedance	600·50K(Ω)(DUAL)
Frequency Response	200~10000(Hz)
Sensitivity	−71±3(dB)(600Ω)
Dimensions	φ43×197(mm)



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Sennheiser 2000 electret headphones sound superb

For some years now Sennheiser have produced a popular range of lightweight dynamic "open-aire" headphones. Now, applying some of their electret microphone technology, they have produced a set of electrostatic headphones with "unipolar" electret transducers. These are claimed to give a wide frequency response and excellent dynamic range.

When we first received these headphones we were a little confused as to whether they were electrostatic or electret. The packaging material and the owner's manual state that they are electrostatic, while an accompanying "blurb" sheet proclaims in fractured English that they are electret. Hmmm...

Subsequent checks on the headphones indicate that they are indeed electret. This means that they do not require a power supply to develop a high polarising voltage — electrets are inherently self-polarised. However, they still require a couple of reasonably large transformers, to match them to the low impedance outputs of audio amplifiers.

As we have noted in a past review of electret headphones, the need for a high voltage polarising supply is not of much consequence since the extra components required add little in cost or bulk — the supply circuit usually consists of one or two diodes and a filter network, running directly from the mains.

In appearance, the Sennheiser 2000 headphones are not particularly prepossessing. They are of all-plastic construction, including the headband. The predominant finish is matte black with some bright work on the earpieces. But whether or not you are attracted by their appearance, they are very comfortable to wear. With reasonably low weight, a fully adjustable and padded headband and padded ear-surrounds they can be worn for long periods without fatigue.

While the Sennheiser 2000 headphones do have padded ear surrounds they do not produce a sealed "cavity". They are amply ventilated on the ear side of the diaphragms. Just why this is so is not apparent from the owner's manual or other information to hand — it may be to obtain correct baffling. Be that as it may, it certainly has a beneficial side-effect — the listener's ears do not become uncomfortably hot during prolonged listening.

As mentioned above, electret headphones require transformers to adapt them to the outputs of amplifiers. The Sennheiser HER 2000 adaptor has provision for connection of two Sennheiser 2000 headsets. The sound level in the second set can be reduced with respect to the first by 6 or 12dB.

The HER 2000 adaptor is connected to the driving amplifier via a cable fitted with DIN piggy-back plug sockets. The idea behind this is to allow the loudspeaker plugs to connect on the back of the adaptor plugs and then provide switching for the loudspeakers via a switch on the adaptor.

Another feature of the HER 2000 is the two LED overload indicators, which light up when the headphones are just about to become audibly distorted. According to Sennheiser this should happen only rarely since the sound pressure level for audible distortion is above 110dB — which is very loud indeed.

Length of the connecting cable from phones to adaptor is adequate at three metres.

Since wave tests of the phones indicate that they have a very wide and well-maintained response to the limits of audibility. No apologies need be made for the bass response, and there is no hint of distress from the diaphragms when driven very hard at low frequencies, up to the point of visual indication of overload. As for the distress of the listener's ears, that is another matter.

On music, the Sennheiser headphones give excellent results. While the sound quality is obviously clean and wide range there is little tendency for surface noise on discs or tape hiss to be emphasised to any extent. At all times they are very pleasant to listen to and they can be driven to much higher levels than previous electrostatic or electret phones we have reviewed. It is fair to say that they are the best we've heard to date.

None of this comes cheaply, as might be expected. The recommended price of the Sennheiser 2000 headset plus HER 2000 adaptor is $245, while extra headsets can be had for $140. Both prices include sales tax.

For further information on Sennheiser products, contact your high fidelity retailer. Trade enquiries should be directed to the Australian distributors, R. H. Cunningham Pty Ltd, 493-499 Victoria St, West Melbourne, 3003, or interstate offices. (L.D.S.)

OUR SECOND BEST IS BETTER THAN MOST OTHERS' FIRST BEST.

TDK's AD (Acoustic Dynamic) is one of the world's finest cassette tapes but not the best cassette tape made by TDK.

Our SA (Super Avilyn) has the edge but that's only if you're using the special bias/equalisation setting on your tapedeck.

However, if you're using the normal or standard setting, you'll have to settle for AD – second best.

Chances are you won't find anything better or with more consistent sound quality for decks with normal tape selector settings (or no selector switch at all). In other words, even if you don't own extravagant equipment, with AD you can still hear extravagant sound reproduction.

You see, because of AD's superior dynamic range at the critical high end, you'll hear any music that features exciting "highs", with amazing brilliance and clarity you won't get from any other tape.

But there is something else you should hear before you try TDK's AD. The price.

Unlike other so-called "super premium" cassettes, AD's price is down-to-earth (that should make AD sound even better).

There's just no comparison between ours and what others consider to be their best. So try the second best cassette we've ever made – AD.

Available in: C45
C60
C90
C120

TDK AD
(Acoustic Dynamic)

SOLE AUSTRALIAN AGENTS:
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CI.P.2

NEW FOR '78

VDU KIT

Exciting new EA project (Feb '78)
We've got the electronics for this new kit – everything except the keyboard, case & CRT. Talk to a computer!

NEW FOR '78

'PHONE-STYLE INTERCOM

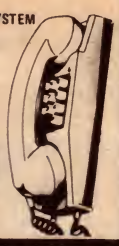
6 UNIT SYSTEM

We searched the world for these! The deluxe telephone-style intercom offers features not normally found in units of this price range. Full privacy – no eavesdropping. Separate conversations simultaneously. Versatile!

BUSINESSES
HOTELS
SHOPS
MOTELS

$42.50 Cat F-1310

12 UNIT SYSTEM



The 12-unit system. Features identical to unit at left. Think how these units would effect efficiency in your organisation! Don't spend huge sums on a PABX you probably don't need. Intercom the easy way!

OFFICES
WAREHOUSES
APARTMENTS
SCHOOLS
RESTAURANTS

$55.50 Cat F-1320

MINI MEGAPHONE

G'day...

What a great idea for sports, shows, fetes, etc – the uni students could use them on demos, too! Fully self contained with 4 penlite batteries in handle, horn speaker for maximum efficiency. How do you think Dick talks to his staff??????

$19.50 Cat F-2030

HANDY SOCKET SET

40 piece

Incredible price for quality socket set! 40 piece, including metric and imperial types, drivers, ratchet, etc. You could pay $40 plus for a fancy set with a fancy brand – but why do no better than these for $16.50. Incredible bulk buying and Dick's overseas contacts make all the difference!

$16.50 Cat T-4670

HOBBYISTS:

BLANK PC BOARD 3.50

NEW! Fibreglass double sided blank PCB, 1oz copper, size 6in x 9in. Ideal for the experimenter. Cat H-5560

RESISTOR PACK 5.90

VALUE: 1/4W resistor pack, quality type, handy values. Less than 2c each! Save. Cat R-7010

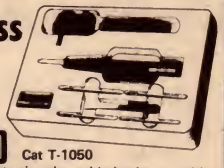
CAPACITOR PACK 6.50

VALUE: Greencap capacitors, 60 in all, with computer-selected values. Top quality! Cat R-7040

WELLER IRON

for all hobbyists

CORDLESS IRON KIT



$32.50 Cat T-1050

Fantastic value soldering iron – with no trailing leads. Complete kit has the iron, (ni-cad battery built in), charger, spare tips, screwdriver and solder. Beat that for value!

FAMOUS MAINS IRON

The old favourite – SP25D.
We've sold thousands of these irons – reliable, simple & great value for money. Spare tips always in stock (see below).
Cat T-1030

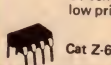
$12.50

tips to suit

Choice of spade tip or cone tip.
Why not have both on hand for all jobs? Always handy to have around.
Spade tip Cat T-1230
Cone Tip Cat T-1220
Both $1 each

DON'T FORGET DICK SMITH FOR ALL COMPONENTS

Cat Z-2145
2N3055 – the old standard. Dick's got'em for only $1.50 each (or less for 10 or more!)



uA741 (may be DIP or mDIP) Cat Z-6382 60 cents – and that's the usual low price, not a special!

NE555 timers – used all over! Cat Z-6145 Just $1.00 each. With '000's more just like it – what value!

ECONOMY M'METER

$8.90 Cat Q-1010 8 RANGES!

A multimeter under $10 these days? What's wrong with it?
Nothing – just another example of Dick's tremendous buying power. 1000 ohms per volt, small enough for the pocket! Battery supplied, test leads too.

DOUBLE METER SPECIAL

Cat Q-2055

Two VU scales. Ideal stereo level meter, tape or cassette deck, mixer

4.50

CHANNEL 9 ROCKS

$2.50 set Cat D-6006

UNBELIEVABLE! Crystals for the CB Emergency channel, 27.065MHz, that were selling for $7.50 just two months ago, now UNDER COST at $2.50! Dick wants to spread a little safety – so anyone who has a hand-held unit now has no excuse!

SEMICONDUCTORS NEW FOR '78

TWO NEW SEMICONDUCTORS FROM DICK SMITH ELECTRONICS – BECAUSE YOU ASKED US FOR THEM!

OA47 GOLD BONDED DIODES – Cat Z-3024 .. .. 45c each

5082-2800 SCHOTKKY DIODES – Cat Z-3230 .. .. $2.90 ea.

Other Xtals

We carry a range of other channel crystals, including the new Aust. CB channels. Just ask us if the channel you want is stocked.

SEE E.A. APRIL ISSUE.

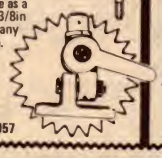
SWORDFISH Marine 27MHz Antenna WITH NEW STYLE BASE

Here it is: our new Swordfish marine antenna complete with the deluxe-style 'Hy-gain'–type base (pre-assembled). Incredible performance on the 27MHz marine band, and around $20 cheaper than our old marine antenna. Quality fibreglass whip, on multi-directional base as illustrated below.

$49.90 Cat D-4071. DUE IN SHORTLY

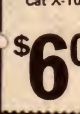
BASE ONLY

Yes, the base is available as a separate item – with a 3/8in adaptor so you can use any 'universal' type antenna.



$19.50 Cat D-4057

TREASURE HUNTERS/ METAL DETECTORS



THE BUILDER'S MATE: It finds those wires, nails etc before your drill or saw does. Ideal for the handyman. Save!

Cat X-1060

$6.00

Cat X-1062

FIND A FORTUNE

$19.50

Quality hand-held treasure & metal detector. No stooping to use!

COLOUR ORGAN KIT

$59.90 Cat K-3140

Our ever-popular Musicolor 111 kit is different – it now has a quality fibreglass printed circuit board complete with parts overlay – for no extra cost. Easier to solder, near zero chance of making errors – and thousands have been built. Make your next party swing with light & music matched.
Short form Musicolor: New f'glass PCB, all electronic components, pots, etc – no h'ware. Cat K-3141 .. .. .. $32.90
Musicolor PCB only: F'glass. Cat H-8318 .. .. .. $4.50

27MHz marine Interference Solvers

Dick has ordered a limited number of 'high side' crystals for the 27MHz marine channels. These crystals should eliminate interference from CB, hospitals, etc. A slight re-tuning of the oscillator may be needed – see your boat club radio officer. Note: all receive crystals only – transmit stay as they are. Order as follows:
27.24 – Cat D-6120 27.88 – Cat D-6123
27.89 – Cat D-6124 27.90 – Cat D-6125
27.91 – Cat D-6126. All $5.00 each.

NOISE CANCELLING MICROPHONE

TWIN INSERTS 600 OHMS IMPEDANCE

At last, our new noise cancelling microphone. Very easy to hold, due to its unique shape. Large push-to-talk switch, acoustically balanced for noise cancelling. With curly cord and mic. plug ready wired to suit CB. Different!

$10.90 INCLUDES PRE-WIRED PLUG WORTH $1.75!

Cat C-1105

AM/FM CLOCK RADIO

NEW FOR '78

Cat A-4446

Deluxe leaf-type clock movement with alarm, plus a quality AM-FM radio. The gentle way to wake up or go to sleep. 240 volt operated, very large and easy to read numerals, even when you're still half asleep! Compare elsewhere; save here!

$39.95

CB CORNER CB CORNER CB CORNER

MINI EXTENSION SPEAKER — IDEAL FOR CB

Cat A-2452

$6.50

Mini size (small enough to go under pillow!) suits low impedance ('earphone' or 'ext sp' outlets on CB, radios, tape cassettes, etc. Long cord with 3.5mm plug supplied.

Cat D-2844

CB Monitor $8.95

Receives all CB channels without tuning. Listen to local CBers, use as TV! monitor, etc!

MIDLAND

Hiker's special: A lightweight unit, 1 channel fitted on 27.240 hand-held frequency. 1 watt.

Cat D-1102

49.50

CB MICS

39.50

Cat C-1114

1930s Style Base Mic. Class for your shack! 600 ohm, wired with plug to suit CBs. Power mic has pre-set level control. Suave!

Cat C-1112

NEW! Deluxe base mic with slider controls, p-t-t bar with lock. With plug, really beautiful & so very economical! See it to believe it –has even got a level meter!

49.50

CB/AM/FM RECEIVER

3 BAND RAOIO RECEIVES THE FULL 27MHz CB band plus; as well as the AM & FM broadcast band. Even has the new 18 Australian CB channels marked on it! Batteries included. Telescopic whip for clarity.

Cat D-2842

$29.50

TWIN TRUCKIES

DID YOU SEE THE 'SPECIAL'

Their twin truckies antennas (they'd call them truckers) were on special for around $45. Look at our normal price!

Why waste money there?

Supplied with full mounting kit for mirror or rack mount, plus wiring harness, plug, etc. And look at that price once more before you waste your money elsewhere!

$35.00 Cat D-4454

DON'T FORGET: Dick's brand new 1978 catalogue FREE next month in Electronics Australia. Order your copy now – don't miss out!

SOLAR CELLS

FREE POWER FROM THE SUN!
Yes! Up to 430mV @ 100mA in sunlight. Space age technology brings you these brilliant solid-state devices. 10 times more potent than cadmium cells — in one tenth the space. These are the same devices as used by NASA in their satellites. Dick obtained them at a ridiculous price when the NASA budget was cut!

Cat Z-4820

ONLY 2.50

GET INTO THE SPACE AGE

Amateurs

see our new range of YAESU gear in amateur section

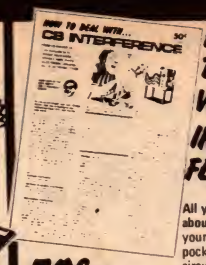
KITS BITS

TAPE CASSETTE MECHANISM

AS USED IN THE E.A. CASSETTE DECK (FEB '78)
Yocom 1000 — 9V motor, complete with electronics for record/playback preamps, etc.
Build a really good cassette deck yourself!

INCLUDES FREE PIANO KEYS

$65.00 Cat X-1032



HOW TO DEAL WITH CB INTERFERENCE

All you need to know about TVI. Keep your license in your pocket! Includes circuit diagrams of audio filters, too!

50c Value Cat B-6025

IS NOISE ANNOYING YOU?

NEW DELUXE NOISE FILTER SYSTEM
Contains • Massive dual line noise filter • • Quality alternator filter • • Deluxe ignition coil filter • • Capacitor noise filter •

Treat all parts of your car professionally and thoroughly. FREE— detailed instruction leaflet telling you how to solve YOUR noise problems Cat A-7950

Cat A-7928 3.75

NOW, at long last, we've got some of those hard-to-get co-axial noise suppressors: BECAUSE YOU ASKED US. Rated at a whopping 60A (o.5uF/100V) they should suppress just about anything on your car!

SAVE $5: now 22.50

FOR CAR RADIOS, CB, MOBILE RADIO, HAM & NOVICE UNITS, TAPE CASSETTES, ETC ETC

WOW! A radar detector under $50.00.

The Dicktracer. It's Australia's cheapest Radar Detector. And it really does work!

49.50 Cat A-8500

Clips to car sun visor, no trailing wires as unit has inbuilt battery which is re-charged at night with cigar lighter cord supplied. So sensitive often goes off near airports, etc. Don't be worried — it means this unit is really working well!

NEW Cat P-2312

Easy-fit PL-259's Suit RG-58U coax, special low price. 1.65

TI 59 power!

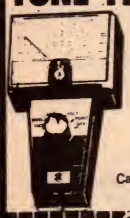
Phew! 960 program steps or up to 100 memories. And the master library module gives up to 5000 steps. It's almost a computer!
Comes with adaptor/charger, vinyl case, programming manual, program/data cards, users manual, master library module . . .
A REAL CALCULATOR!

Cat Q-3710

$299.51 TAX FREE

328.70

TUNE IT AND SAVE



YOU can be a mechanic and tune your own car — easily — with the brilliant new Dick Smith tune-up analyzer. It does all the electrical checks you normally pay the garage a fortune to do. Suits four, six or eight cylinder cars, and has full instructions. Comes with high quality alligator leads & current shunt. Start saving money NOW!

Cat A-8514 19.95

SPECIAL TV GAME KIT WITH GUN FREE!

Cat K-3432

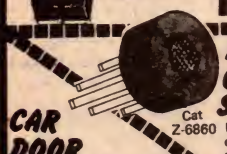
49.50 39.50

BUILD THE KIT THEN PLAY WITH IT! 5 selectable games from one unit. • Rifle 1&2 • Tennis • Soccer • Squash • Practice • And it now comes with the FREE gun mechanism (no electronics) normally $6.50 extra! Only 3 IC's and 3 transistors in this renowned kit. Has sound (inbuilt) and can be used with joystick pots for full up/down plus back/forth bat control (Joystick pot Cat R-1976; $3.50). Fully battery operated, plugs into any TV set. Two armchair control units supplied as well as master control shown. Value!

DONT PAY A MINT FOR ROTARIES

1.65 1.40

Why pay more? Reliable, tough, all combinations available:
S-2302 6p/2pos S-2303 4p/3pos
S-2304 3p/4pos S-2305 2p/5pos
S-2306 2p/6pos S-2312 1p/12pos



FIGARO GAS SENSOR

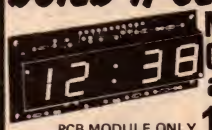
Cat Z-6860 Used in ETI gas detector. Highly sensitive units. Cat Z-6860

CAR DOOR SWITCHES 1.20 pair

Ideal for car alarms, etc, where courtesy lights not fitted. Pk. 2 — Cat L-5256

8.90 Cat L-5256

BUILD A CLOCK!



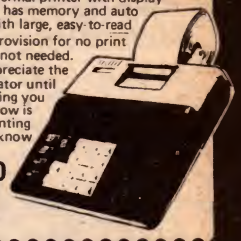
MA1002 Clock on a chip

PCB MODULE ONLY 13.50

All the works on one PCB — done for you already! Just add a supply. Cat X-1052 .. ..$13.50
Full works — module, transformer and switches. Cat K-3434 .. $19.75

FORDS Printing Calculator

What's better than a digital display calculator or a printing calculator?
A digital AND printing calculator in one!
The Ford's 12 digit thermal printer with display — runs off mains power, has memory and auto constant functions, with large, easy-to-read digits and keys. Has provision for no print (to save paper) if it is not needed. You cannot really appreciate the features of this calculator until you try it. But one thing you will appreciate right now is the price: the first printing and digital model we know of under $100.00!



Cat Q-3018 99.50

$92.73 TAX FREE

HAVE YOU LOST AN ANT?

Cat D-4077

CB antennas are being knocked off fast! If you've lost yours, here's the answer: Our famous D-4076 no-snip helical is now available without the base & co-ax lead. So save money. Also for anyone wishing to convert to this brilliant design

22.50

D-4076 will still be available with the works if you want it . . .)

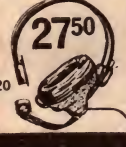
ANTENNA LAYOVER as easy as 1-2-3

6.95

Woops — low building. It's easy to wipe out your antenna — trees, carparks, etc etc. . Solve the problem of the bent or broken antenna with the Dick Smith Antenna Lay-over. Push-button simplicity — 3 position, vertical, 45° & flat.
Cat D-4506

HEADSET with Mic & 'Phone

Switch stays in hand on wheel, free to move. Impedance of mic matches 600 ohms of CB. 'Phone comes with plug attached (3.5mm). Mic plug not supplied (P-1824; $1.20).



Cat C-1120 27.50

DICK SMITH CASSETTE SPECIAL

UD only $2.50

That's right: a UD tape at just $2.50! Try them — you won't be able to tell the difference between it and those much higher priced tapes!

C60 LN	C-3350	$1.50
C90 LN	C-3352	$1.99
C90 UD	C-3354	$2.50

Special price while stocks last — be quick!

CAR RADIO SPECIAL

79.50 Cat A-5980

45.00

High sensitivity push button car radio — not one of your 'back streets of Kowloon' sets, either. Quality unit, chosen by Dick Smith from years of car radio experience.

NEW! Mini Cassette

How's this value? Battery operated, complete with it's own condenser microphone (inbuilt) for around half the price of equivalent cassette units elsewhere!

- Comes with set of batteries, blank cassette and earphone!
- Easy-to-use fingertip controls.
- High sensitivity.

Ideal for businessmen, students, etc. AC adpator also available.

49.95 Don't pay $89

Cat A-4050

NEW! Micro Cassette

FITS INTO YOUR SHIRT POCKET! Tiny device runs off penlite batteries, takes micro cassettes (not supplied, see below). Comes with FREE set of batteries.

Cat A-4040 39.00

COMPARE ELSEWHERE AT AROUND $59.95. Why waste good money there?

Micro-cassette to suit above unit. 15 mins. per side.

Cat C-3360 2.95

10 or more $2.50

Light Dimmer

Easy to install

Cat X-1112

MAKE YOUR OWN MOOD — with a light dimmer.
- Easy installation — fits in place of your existing light switch.
- Large AND small plate supplied.
- Suits bulb-type lights.

6.90

Save on mains fittings

Line Plug	Cat P-5400	55c
Side Entry Plug	Cat P-5402	60c
Piggy Back Plug	Cat P-5405	95c
Line Socket	Cat P-5410	$1.15
Surface Socket	Cat P-5415	80c
Child Proof Plug	Cat P-5420	30c
Suppressor Plug	Cat P-5425	$2.65
Double Adaptor	Cat P-5435	55c
Double Wall Outlet & TV	Cat P-5540	$5.00
Wall outlet (safety shutter)	Cat P-5550	$2.20
Double wall outlet " "	Cat P-5560	$3.80
Delay Switch	Cat P-5580	$5.40

DICK SMITH ELECTRONICS

SHOP HOURS
Mon-Fri 9AM 5.30PM
Sat 9AM 12 noon
(Brisbane 1 hour earlier)

bankcard welcome here

Order value	P&P charge
$5 - $9.99	$1.00
$10 - $24.99	$2.00
$25 - $49.99	$3.00
$50 - $99.99	$4.00
$100 or more	$5.50

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125 York St.
City. Ph 29 1126
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Bankstown. Ph 709 6600.
Open 'til 8PM Thursday

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Parramatta. Ph 683 1133
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City. Ph 212 1962
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MAIL ORDER DEPARTMENT PO Box 747, Crows Nest, NSW 2065. Phone 439 5311 Post & Pack extra

WE HAVE DEALERS RIGHT ACROSS AUSTRALIA THERE'S ONE NEAR YOU!

A practical approach to electronics — 2

RLC Bridge

This completely new design for an RLC Bridge has its own low distortion oscillator and ten overlapping ranges for resistance and capacitance measurement. Inductors can be measured also, using external standards. The device is battery operated but may be run from a mains plug-pack power supply.

by LEO SIMPSON

Even in these days of digital instruments, the tried and proven RLC bridge is a handy and easy to use piece of test equipment. It can be used to check the values of new and used components and also to determine the actual value of wide-tolerance capacitors such as electrolytics and ceramics. There are ten ranges on this instrument, enabling measurements from 10 ohms to 10 megohms and from 10 picofarads to 10 microfarads.

Useful measurements can be made on inductors with values down to about a few hundred micro-henries. When making these measurements it may be necessary to connect a 1k potentiometer (connected as a variable resistor) in series with the external standard inductor to balance the series resistance of the unknown inductor.

The principle of operation is simple and is based on the Wheatstone Bridge. This is named after Sir Charles Wheatstone (1802-75) who, while doubtless having independently invented it himself, acknowledged that he was beaten to it by a Mr S. H. Christie, some ten years previously.

Fig. 1 shows the basic Wheatstone Bridge. No doubt many hapless students have come across it in archaic form in ill-equipped science laboratories. It really consists of two voltage dividers strung across a common power supply. The first voltage divider consists of R1 and R2 where the value of R1 is known and R2 is unknown. The second voltage divider is R3 and R4 which in reality are both part of a potentiometer.

In use, the operator adjusts the potentiometer so that no current flows through the null indicator, ie, so that the bridge is in "null". In the old days the null indicator was usually a sensitive mirror galvanometer, but these days it is more likely to be an amplifier driving a milliammeter.

Since no current flows through the indicator when the bridge is in null, this means that the voltages at both sides of the indicator are the same. This means that the ratios of the two voltage dividers are the same. Therefore:

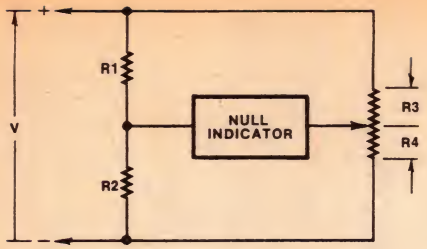
$$\frac{R1}{R2} = \frac{R3}{R4}$$

If we invert both sides of the formula, cross-multiply and divide, we get:

$$R2 = \frac{R1.R4}{R3}$$

So that if R1 is the known value (the standard) we can multiply it by the ratio of the potiometer to find the value of the unknown, R2. In practice, the potentiometer has a calibrated scale and the standard component is a multiple of ten, so that measurements are straightforward and do not require any calculation.

Note that the accuracy of the bridge is not



$\frac{R1}{R2} = \frac{R3}{R4}$, R2 (UNKNOWN) = $\frac{R1.R4}{R3}$

FIG. 1

affected by changes in the voltage source or sensitivity of the null indicator, although the "sharpness" of the null will be a function of these two variables.

If capacitors and inductors are to be measured the voltage source must be AC, preferably a sinewve of about 1kHz. This results in a reasonable range of impedance values for the most commonly used capacitors and inductors. Lower frequencies result in very high impedance values for small capacitors, while higher frequencies gives very high impedances for inductors of 1 millihenry or less.

For resistance measurements, it is immaterial whether the voltage source is AC or DC, although the null indicator must be designed to suit.

Fig. 2 shows the Wheatstone bridge concept adapted for measuring capacitors and inductors, as well as resistors. We still have two voltage dividers connected across a voltage source, while the null indicator is schematically shown as an amplifier driving a meter. Not shown is some sort of rectifier which is required between the output of the amplifier and the meter.

There is one more wrinkle. The impedance of capacitors is inversely proportional to capacitance so if the same scale is to be used on the ratio potentiometer, the standard and unknown need to be swapped around for capacitance measurements.

Now if you understand the foregoing discussion we can progress to discuss the complete circuit. If not, I suggest you go back and re-read the foregoing. Fig. 3 is the complete circuit diagram.

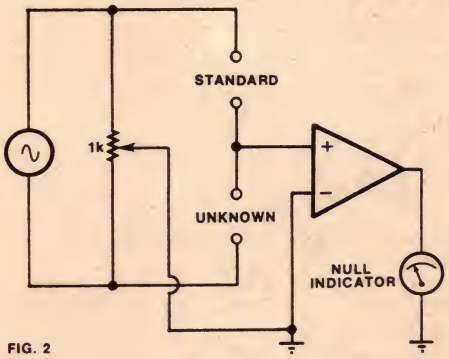


FIG. 2

Some of the requirements for the sine wave source for the bridge are that it should have a low output impedance, be completely floating with respect to the null indicator circuitry and require no adjustment. Our circuit, based on 555 and 741 integrated circuits plus a miniature transformer, meets these requirements.

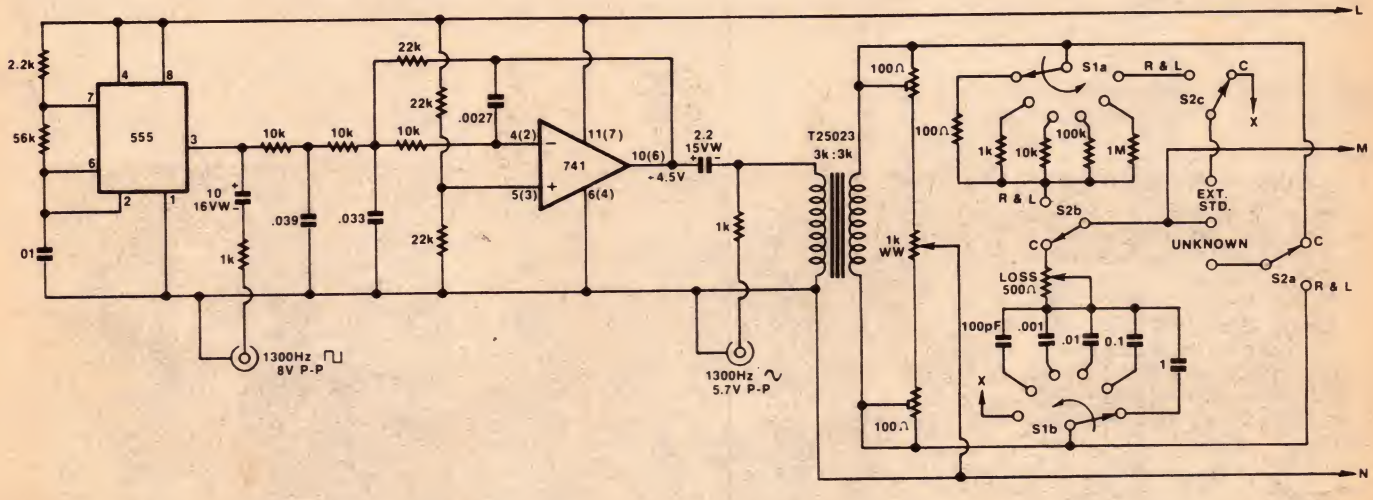
The 555 timer IC is connected to provide a 1300Hz rectangular wave with a duty cycle very close to 50%, ie, it is close to being a perfect square wave. The output of the 555 is fed to a third-order Butterworth filter employing a 741 operational amplifier. It is based on the low-pass filter in the "Active filter unit" featured in the February 1978 issue of "Electronics Australia".

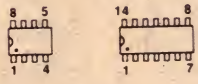
The low-pass filter has a slope of —18dB per octave above the —3dB point at 1kHz. Hence it effectively removes all the harmonics of the square wave. Harmonic distortion of the resulting 1300Hz since wave is 1.5%, and is predominantly 3rd harmonic. The higher harmonics are masked by residual noise of the circuit.

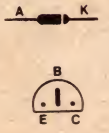
Readers may wonder why the frequency of the 555 timer is not set at 1kHz to match the nominal —3dB point of the following filter. If this was the case, the filter would be driven into overload because the amplitude of the fundamental frequency in a square wave is greater than the amplitude of the square wave itself.

A small transformer is used to couple the low impedance output of the filter to the bridge circuit. This is necessary because the null indicator amplifier has one side of its input circuit connected to the negative supply rail, and so requires that the bridge have a "floating" voltage source.

The bridge itself is quite straightforward. The ratio potiometer is 1k and has small presets in series to provide for scale calibration. A 2-pole rotary switch S1 selects the standard resistors or capacitors, while switch S2 swaps the standard and unknown arms from one side of the bridge to the other for capacitance measurement. Provision is







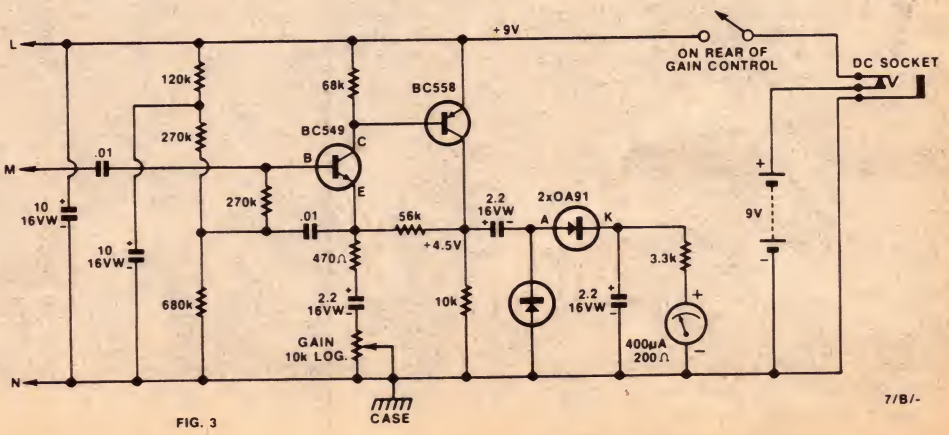
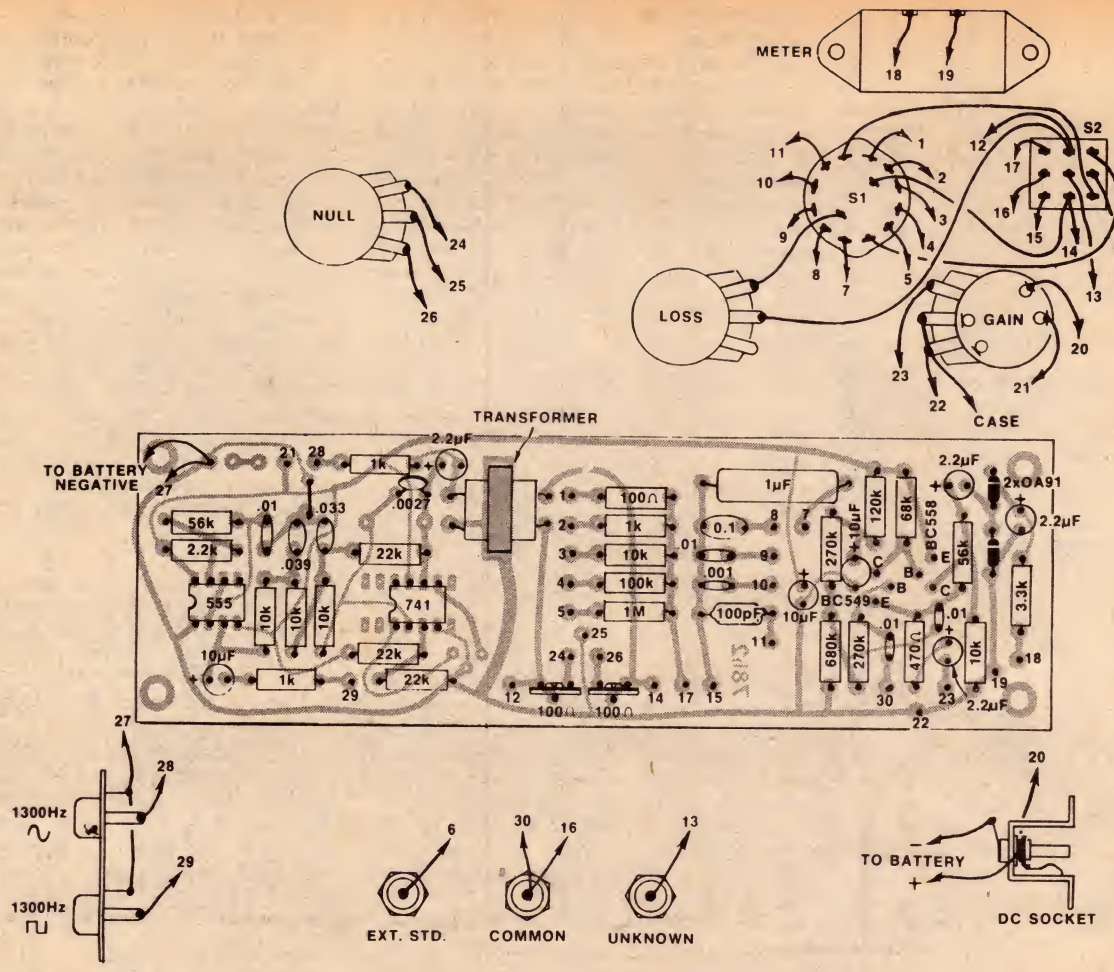


FIG. 3

RLC BRIDGE



This wiring diagram and the photograph below show how the Bridge is wired.

made for connection of external standards, for things like measurement of inductance.

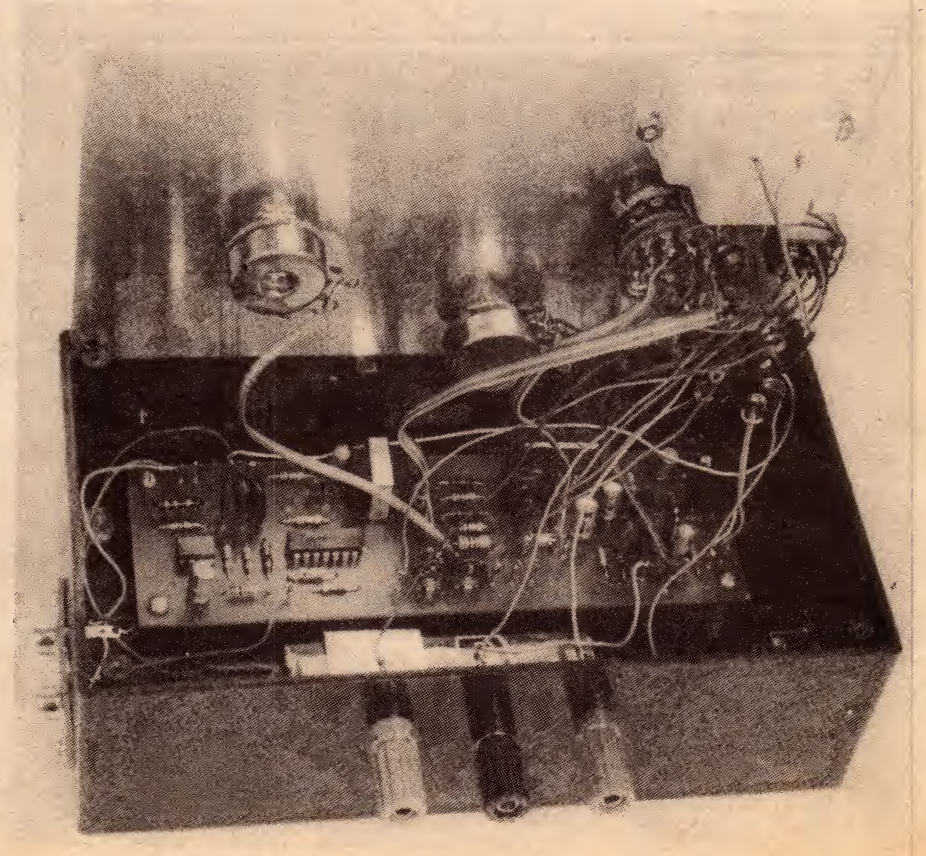
A potentiometer connected in series with the switching for the capacitance standards allows the loss factor of electrolytic and low voltage ceramic capacitors to be balanced out. Most other capacitors have such a low power factor that it will not be necessary to touch the Loss knob. Just leave it at minimum setting.

When high value resistors or low value capacitors are being measured, one side of the bridge becomes a very high impedance voltage divider. This means that the input of the null detector amplifier must also have a very high input impedance. Accordingly, the two-stage direct-coupled null detector amplifier has a "boot-strapped" input.

Bootstrapping is a form of positive feedback, used in this case to effectively negate the shunting effect of the voltage-divider bias network for the first transistor. It works as follows.

One end of the 270k bias input resistor is connected to the emitter of the BC549, as far as AC signals are concerned, by a .01uF capacitor. By virtue of emitter follower action, almost 100% of the AC input signal appearing at the base of the BC549 transistor also appears at its emitter. This means that very little of the input signal current flows in the 270k resistor, and thus its value is effectively multiplied many times.

A 10k potentiometer in the feedback loop of the amplifier varies the gain. Reducing the gain of the null detector "broadens" the null



of the bridge and makes it easy to find a rough null. Then the gain can be increased, to obtain a very sharp and deep null to provide an accurate measurement.

The output of the null detector amplifier is fed to a half-wave voltage doubler rectifier (also known as a "Diode pump"), consisting of two capacitors and two germanium diodes. The lower forward voltage drop of germanium diodes, compared to silicon, gives a worthwhile effective increase in gain. The 3.3k resistor in series with the meter movement offers a degree of protection against overloads.

The complete bridge circuit is powered from a nominal 9V supply, provided either by an Eveready 2362 battery or an external plug-pack mains supply such as the A&R PS309 triple voltage battery eliminator. These are now available at very reasonable prices, which make batteries suffer by comparison.

There are a number of other advantages besides price when using a plugpack. Completely enclosed and double-insulated, they are safer and more convenient than a built-in supply. And where the circuit can be sensitive to mains hum, as in this case, the plugpack has another advantage over a built-in mains supply.

The regulation and filtering of plug-packs are no better than can be expected from a small transformer with bridge rectifier and single filter capacitor. However, the bridge circuit has been designed with these factors in mind, so that operation is satisfactory whether it is running from battery or plugpack.

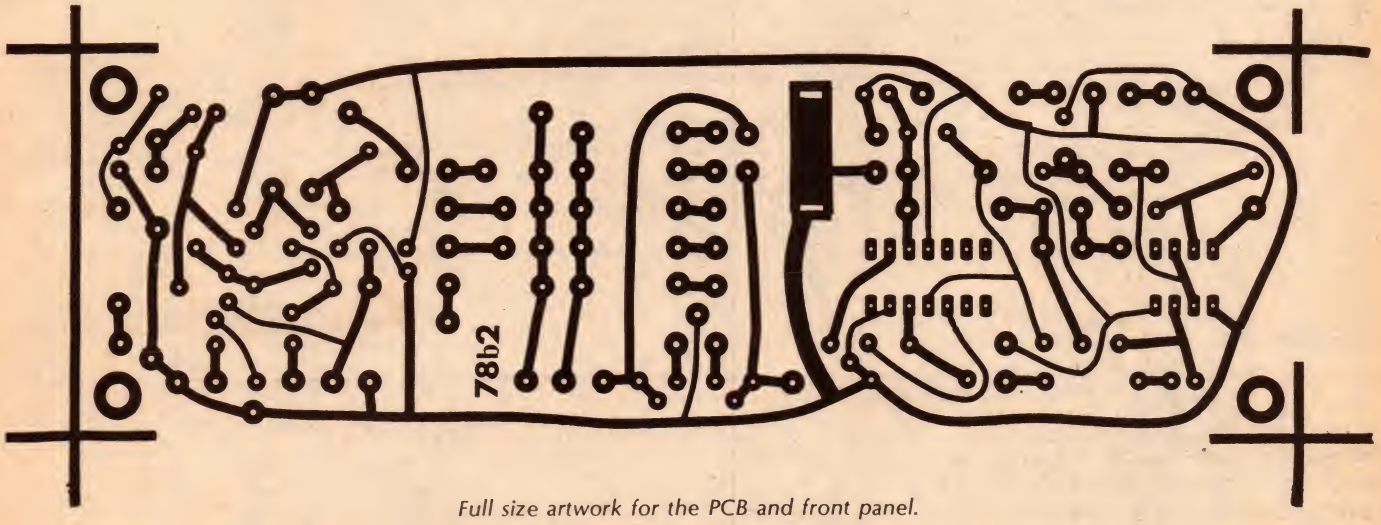
We housed the RLC bridge in an economical plastic box measuring 197 x 60 x 112mm (W x H x D) and available from most parts suppliers. Both the thin aluminium lid and the plastic box are easily drilled and worked. Best results are obtained if holes are made with a small drill and then enlarged to the correct size with a tapered reamer. We hope that parts suppliers will have a screen-printed and drilled panel available for this project.

Fit the plastic box with four rubber feet so that it does not slide about.

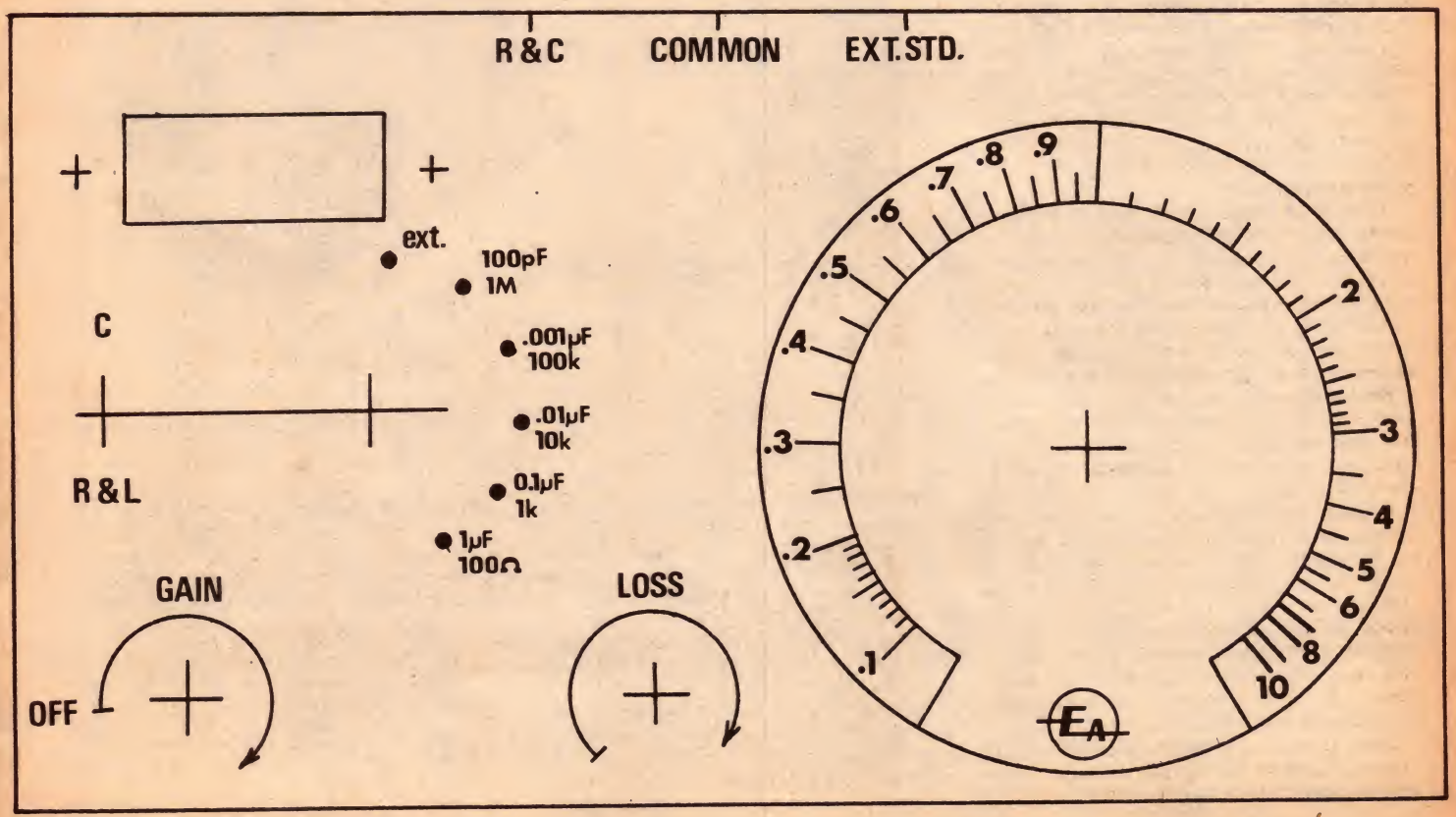
Most of the components with the exception of switches, potentiometers and the meter, are accommodated on a PCB measuring 160 x 50mm. It is essential that the PCB have the highest possible insulation resistance, otherwise the unit will be unsatisfactory when measuring high values of resistance. Preferably the PCB should be made of fibreglass but in any case, check it on the highest resistance range of your ohmmeter before beginning assembly.

The insulation resistance between any two tracks on the PCB should be several hundred megohms or more.

Assembly of the PCB is straightforward.



Full size artwork for the PCB and front panel.



The PC pattern for the 741 op amp suits 14-pin and 8-pin devices. Our photo shows a 14-pin device fitted, while the wiring diagram shows an 8-pin 741. The transformer was supplied by Dick Smith Electronics. It is an iron-cored 3k:3k coupling transformer, stamped T-25023 on the lamination clamp. DSE catalog number is M-0222.

The five resistor and five capacitor standards should be the closest tolerance available, preferably 2% or better. The preset 100 ohm potentiometers are miniature types with the pins at 0.1in spacing. Any germanium signal diodes available may be used.

Use PC pins to simplify connections to the PCB. There are a few holes on the PCB which are unoccupied. We make this remark just in case readers think there is a mistake.

We have provided outputs, via a pair of RCA phono sockets, from the sinewave filter and square wave oscillator. These are optional and can be omitted if not required.

The 1k ratio potentiometer is a 3 watt wirewound type made by IRH. Do not use other types as they will not match the calibrated scale. The edge-rading meter has a sensitivity of 400 microamps FSD, and fits a panel cutout of approximately 35 x 15mm.

Binding posts-cum-jack-sockets were used for the three bridge terminals although spring-loaded terminals may be just as suitable. The battery clamp is made from a scrap of aluminium and is secured with the nut for the "ext. std." terminal.

A special connector is used for the external power supply, of the type used on many battery-operated appliances. The outer connector of the matching plug is positive. They are available with 2.1mm or 2.5mm centre-pin. The A&R plugpack is compatible with both, but whatever type of external power supply connector you obtain, ensure that you are also supplied with matching metric screws.

Connections from the PCB to other components may be made with rainbow cable split and cut into suitable lengths. It is important that the connecting wires to the three terminals, and those to the 2-position changeover switch be run separately, otherwise capacitance between wires will prejudice accuracy.

The front panel should be connected to the negative supply rail to minimise the effects of hand capacitance. The connection can be done by soldering a wire to the locknut for the gain potentiometer and then connecting it to the pot wiper.

The cursor knob for the ratio potentiometer can be made by gluing a suitable shaped piece of transparent plastic to a large knob. The cursor line can be scribed on the plastic with a compass point.

With the wiring complete and the instrument working, the job of calibration remains. We suggest you purchase three close tolerance resistors (ideally 1% or better) of 100 ohms, 1k and 10k. This will enable initial calibration using the 1k resistance range.

As a first step in calibration, make sure that the ratio potentiometer shaft and the calibrated scale are concentric. If this is not the case, you will tear your hair out trying to calibrate it! If all is well, set the knob with its cursor so that it swings to the extremities of the scale. If there is slight under or over-travel, make it symmetrical.

PARTS LIST

1 plastic case with aluminium lid, 197 x 60 x 112mm
1 screen-printed control panel
1 PCB, 78b2, 160 x 50mm
3 binding posts, red, black and green
4 knobs
1 2-pole, 6-position rotary switch
1 3-pole, 2-position toggle switch
1 edge-reading meter, 200-400uA FSD
1 Eveready 2362 9V battery plus two connectors
1 miniature iron-core coupling transformer, 3k:3k, DSE M-0222 or equivalent

OPTIONAL
1 A&R PS309 or similar 9V plug-pack
1 2.1mm DC input jack socket plus suitable metric screws
1 pair of RCA phono terminals

SEMICONDUCTORS
1 555 timer integrated circuit
1 741 op amp integrated circuit
1 BC549 NPN low noise transistor
1 BC558 PNP transistor
2 OA91 or similar germanium diodes

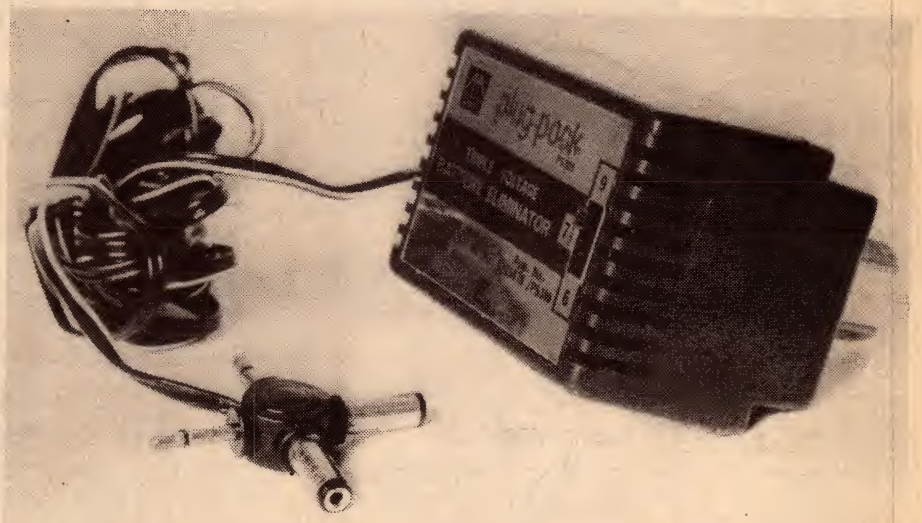
CAPACITORS
3 x 10uF/16VW electrolytic
4 x 2.2uF/25VW electrolytic
1 x .039uF metallised polyester
1 .033uF metallised polyester
3 x .01uF metallised polyester
1 .0027uF metallised polyester or polystyrene

RESISTORS
(¼ or ½W, 5% tolerance)
1 x 680k, 2 x 270k, 1 x 120k, 1 x 68k, 2 x 56k, 3 x 22k, 4 x 10k, 1 x 3.3k, 1 x 2.2k, 2 x 1k, 1 x 470 ohms.
1 x 10k (log) switchpot
1 x 1k 3W wirewound potentiometer (IRH)
1 x 500 ohm potentiometer
2 x 100 ohms preset potentiometers with 0.1in pin spacing.

STANDARDS
(close tolerance)
1 1uF metallised polyester
1 x 0.1uF metallised polyester
1 x .01uF metallised polyester
1 x .001uF metallised polyester or polystyrene
1 x 100pF polystyrene
1 x 1M, 1 x 100k, 2 x 10k, 2 x 1k 2 x 100 ohms.

MISCELLANEOUS
4 ⅜-inch spacers
4 rubber feet
26 PC pins
Aluminium battery bracket, perspex for pointer knob, rainbow cable, screws, nuts, washers, solder.

NOTE: Components with lower ratings may be used provided their ratings are not exceeded. Components with higher ratings may also be used if physically compatible.



The A&R PS309 presents a neat and economical way to power the Bridge.

Set the two 100 ohm presets to their mid-positions. Then connect the 100 ohm resistor and select the 1k range. The null should coincide precisely with the "0.1" setting. If not, tweak the preset slightly — the one nearest the 741. Now connect the 10k resistor and null the bridge again. It should coincide with the "10" setting. If not, tweak the other preset.

This will throw out the first adjustment, and it will be necessary to go over the settings a couple of times to bring both ends of the scale into line. Having done that, check the centre of the scale by connecting a 1k resistor. This should line up on "1" automatically. If sufficient error is noted, the cursor knob should be shifted slightly on the potentiometer shaft. This will make it necessary to go over the calibration procedure again.

At this stage, try to avoid throwing the unit on the floor and stamping on it. It makes it harder to calibrate!

Once calibration has been performed on the 1k resistance range, all the other ranges should be correct, consistent with the tolerance of the standard components.

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by PHILIP WATSON

The basic idea behind most intercom systems is quite simple: At each station a small speaker performs the dual function of microphone or speaker, as required, in conjunction with a single amplifier. The switching is so arranged that the connections to the amplifier can be reversed, according to whichever party wishes to speak.

The main differences between intercoms concern the number of stations, the arrangement of the press-to-talk switching circuits, the status of each station (whether master or slave), whether all stations have — or need — complete privacy, and so on.

One of the simplest arrangements provides for a press-to-talk button at the master station only — plus an on/off switch — with a simple call button circuit from the slave end to attract attention.

This arrangement has both good and bad points. On the credit side is the fact that the slave station can be operated "hands off"; a convenient facility where the person at the slave end may be unable to operate a press-to-talk switch.

The very young, the very old, or the invalid may come into this category.

Technically, it has the advantage that it is relatively simple and normally requires only a three conductor cable between stations.

The main disadvantage is loss of privacy at the slave end. By switching on the amplifier at the master station it is possible to eavesdrop on the slave position, and with little chance that the slave party would be aware of the fact.

While this is unlikely to present a problem in the domestic situation, it could be undesirable in a business or factory environment. No one likes to think they can be spied upon and, equally, no one likes to be in a position where they can be accused of spying.

A further disadvantage is the need to provide separate switches for the on/off and press-to-talk functions.

It is not easy to interconnect these in a completely foolproof manner, so that there is a risk that the system will be left on after use, with consequent waste of battery power.

The system we are about to describe takes all these factors into account. In its basic form it provides press-to-talk control from each station, and therefore, complete privacy. No seperate on/off switch is needed and there is no risk of wasted battery power. It would be ideal for small business or industrial applications.

At the same time it can be easily modified to provide remote monitoring of a baby or invalid and/or two-way conversation with all switching at the master end.

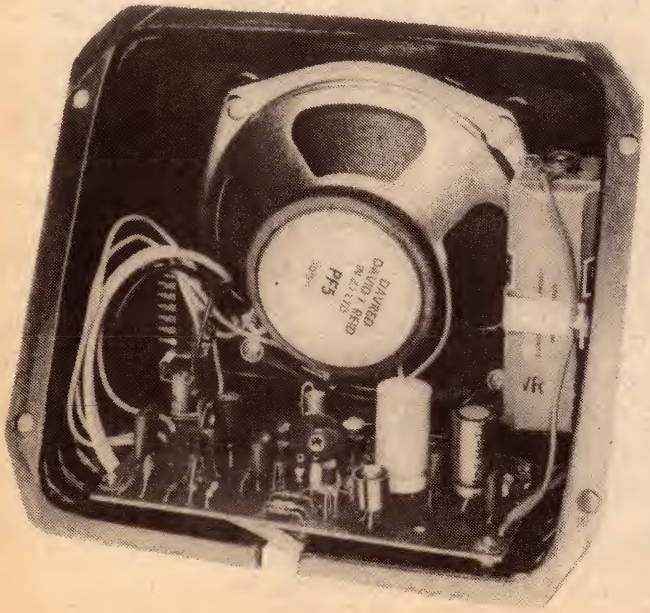
Other points to be considered are the amount of power delivered by the amplifier, the sensitivity of the amplifier, and the size of the speakers to be used. All these factors affect the ultimate performance of the system but, in turn, are governed by the environment in which the system has to work.

There is a vast difference, for example, between the level of sound required in the domestic situation or a quiet office, and that required in a workshop with significant ambient noise plus, perhaps, a larger area to be covered.

Again, we have chosen a design which is quite versatile, In its basic form it will deliver enough sound for the domestic or office environment but it can, with only minor circuit changes, be upgraded to deliver considerably more power where this is desirable.

Another factor governing both the sensitivity and available sound is the size of the speakers. In practice 75mm is about the smallest useful size, and 125mm about the largest. A possible compromise would be a 75mm x 125mm oval type.

The system as described will perform adequately in quiet locations when fitted with typical 75mm speakers, but will provide significantly more sound output, and better sensitivity, with



An interior view of the main unit as built around an auto extension speaker box. (See also top of this page.) The amplifier board is mounted against the rear of the box, and the battery clamped to one side. Note the press-to-talk switch on spacers at the left.

125mm types. A combination of 125mm speakers and increased power output from the amplifier provides an impressive performance, should it be needed.

The amplifier is based on the Low Power Audio Module described in the April 1976 issue (File No. 1/MA/51) and also used in the Playmaster 760 Organ. It is a logical choice, having a power output of up to 2W (depending on the rail voltage) a high order of stability and very good thermal tracking. At the same time, it is basically simple to construct.

To this we have added a preamplifier stage (BC549, BC109 etc) giving a gain of approximately 50 times. Also, we have increased the gain of main amplifier by a factor of two by decreasing the 47 ohm feedback resistor (5) to 22 ohms.

We also reduced the associated electrolytic capacitor (100uF)to about 10uf to provide some low frequency roll-off and better speech quality, particularly with the 125mm speakers.

The only other significant change was to use the TT800/TT801 output transistor combination in place of the MU9660 and MU9610 used in the original. The main difference is physical, in that the 800/801 types are not designed to bolt to the heatsinks etched into the board. Instead, they are supplied with their own heatsinks.

(While there have been rumours that the TT800/TT801 transistors are going out of production — they were exclusively Australian types — they are now being made overseas and imported. There appears to be ample stock at present. Note also that some versions of the BD135/BD136 pair have a lead configuration which is not readily compatible with the board terminations when the transistors are bolted to the board.)

To accommodate the pre-amplifier we have produced a new board, and this might well replace the original board for many applications. It could still be used even if the pre-amplifier was not required, or not required immediately, and the original input points have been retained.

For the basic system we have settled for a 9V supply — a type 2362 battery or similar — and under these conditions the amplifier will deliver a little over 0.5W into an 8 ohm load. This provides a respectable level of sound when fed to a 75mm speaker. Similarly, a 75mm

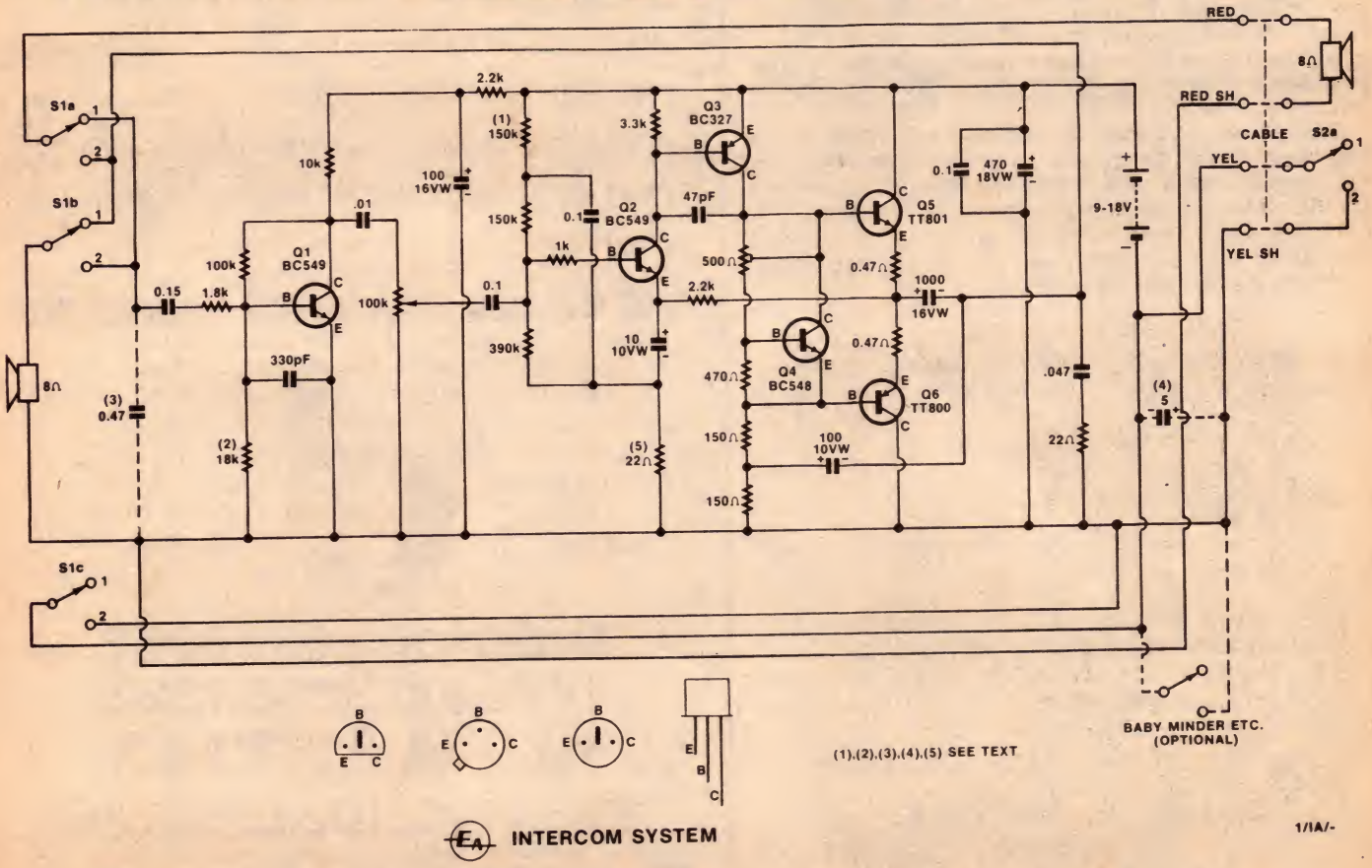
PARTS LIST

1 Printed board, 125mm x 60mm, code 78/ia/2
1 TT801, MU9610, or similar transistor
1 TT800, MU9660, or similar transistor
2 BC549, BC109, or similar transistor
1 BC548, BC108, or similar transistor
1 BC327, 2N3638, or similar transistor

RESISTORS
(½W unless specified

2 0.47 ohm	*1 3.3k*
1 22 ohms	*1 10k*
1 47 ohms	*1 18k*
2 150 ohms	*1 100k*
1 470 ohms	*2 150k*
1 1k	*1 390k*
1 1.8k	*1 500 ohm tab pot*
2 2.2k	*1 100k tab pot*

CAPACITORS
1 47pF ceramic
1 330pF ceramic
1 .01uF LV polyester (greencap)
1 .047uF LV polyester (greencap)
3 .1uF LV polyester (greencap)
1 .15uF LV polyester (greencap)
1 10uF electrolytic (10V) PC type
1 100uF electrolytic (10V) PC type
1 100uF electrolytic (16V) PC type
1 470uF electrolytic (25V) PC type
1 1000uF electrolytic (16V) PC type
2 75mm 8 ohm speakers OR
2 125mm 8 ohm speakers
1 4 pole, 2 position "Schadow" switch, type F-4UOA
1 2 pole, 2 position "Schadow" switch, type F-2UEE (Optional, monitor facility)
Knobs to suit (F1-15-H4)
Figure 8 stereo shielded cable or 2 pair telephone cable
1 9V battery, Eveready 2362 or similar
4 10mm spacers, tapped ⅛in Whit
1 pair battery connectors, hook-up wire, nuts and bolts



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ED2

speaker, as a microphone, will deliver enough signal to drive the amplifier to full output with normal speech at about 25cm.

Note that this order of performance assumes that the speakers are mounted in a typical case. When using the 75mm speakers, particularly, performance can be quite disappointing if they are not baffled in some way.

Switching calls for a three pole changeover switch at the master end and a simple single pole push button at the slave end. With the system at rest the slave speaker is connected to the input of the amplifier and the master speaker is connected to the output.

Thus the system is ready to work from the slave to the master station, but cannot because the amplifier is not activated. Further, it can be activated only by the press-to-talk button at the slave end, thus ensuring privacy.

The master switch performs the dual function of transposing the two speakers between the amplifier input and output terminals and switching on the amplifier.

In previous designs we used rotary switches, fitted with spring loaded lever actions, mainly because they were the most readily available type. This type is now rather scarce, and probably expensive, so we have chosen a push button type which is much more readily available.

These are the "Schadow" brand, distributed by IRH Components. For the master station we used type F-4UOA (4 pole change-over) and for the slave station type F-2UOA (2 pole change over). Both have more contacts than needed, but are quite reasonably priced.

Use of a push button in place of a lever action suggests that it needs to be located on top of the cabinet, rather than the front, to allow easy one-handed operation.

If it is desired to fit a remote monitoring circuit, the additional wiring is shown dotted on the circuit. For monitoring the switch needs to lock in position, but for two-way conversation should be a spring loaded type. A good compromise is a modified "Schadow" push button with a press on/press off action. (Type F-2UEE) Connection between stations requires a four conductor cable. Two types are available; twin shielded "figure 8" stereo cable, and twin pair telephone cable, which is unshielded.

The latter is a few cents cheaper per metre, but has some disadvantages. The main ones are that it is not flexible and being unshielded, it is prone to pick up signals from broadcast stations and sundry noises from appliances.

We used about 12 metres of this type for our initial developmental work, just to see whether it was practical. We were able to control the RF pickup effectively by means of a capacitor (3) across the amplifier input and, superficially, it appeared that this was all that was needed.

Later we became aware that there was a marginal tendency to supersonic instability when the system was activated from the slave end, apparently due to the signal component in the battery leads being coupled into the voice coil leads connected to the amplifier input.

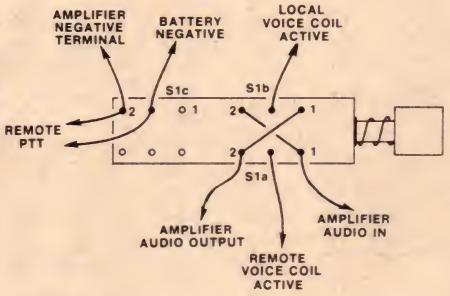
We eventually controlled this by (1) increasing the capacitor across the amplifier input to 0.47uF and (2) connecting an electrolytic capacitor (4) across the slave battery pair, at the amplifier end.

Even so, we finally fitted twin shielded stereo cable and found, as we expected, that we could dispense with both capacitors, although we suggest that about 0.1uF be retained across the input as a general precaution against instability due to other causes.

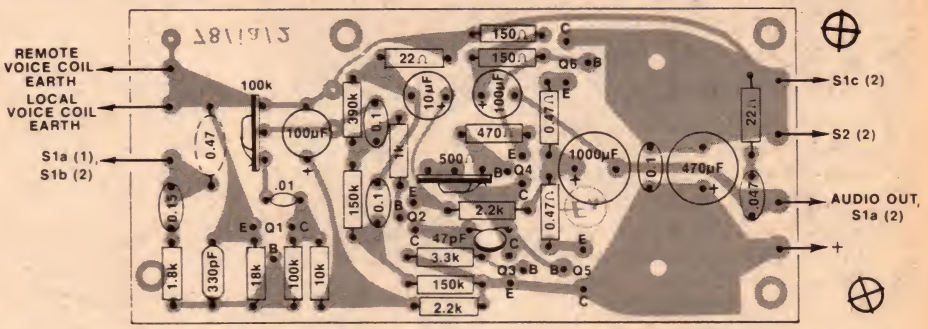
To sum up we suggest that the unshielded cable is worth trying if it is available, if there is a CRO available to check for supersonic instability, and if you are prepared to take the extra precautions we found necessary. Otherwise play safe and use shielded cable from the start.

The matter of earth returns is important in any amplifier set-up, and especially so an intercom system. In particular, it is essential to avoid coupling between input and output by reason of their being required to share a long, common return path.

Thus, in the intercom application, the ideal arrangement would be for the unit functioning as a microphone to be returned to the input end of the board, and the unit acting as a speaker to



This detailed drawing should assist constructors to wire the F-4UOA (or similar) master station switch.



The component layout on the printed board, shown from the component side. Note that the 0.47uF capacitor shown dotted at the input end of the board should be needed only with unshielded cables. Take care identifying transistor leads.

The printed board pattern shown full size. This new board will still suit the original Utility Amplifier circuit, with the advantage of the pre-amplifier pattern, should this be needed. The input pads to the main amplifier have been retained.

return to the output end.

In practice, the switching to achieve this would be unduly complicated, so we try to settle for a common point which offers a good compromise. In this case both voice coil return circuits should be connected to the input end of the board, and an adequate number of terminating pads have been provided.

Finding a suitable box to house the speakers and associated equipment at each end was one of our biggest problems. We investigated a wide range of types, but rejected most for one reason or another.

A major problem was cost. The most suitable styles were quite expensive, particularly in relation to the cost of the overall project. On the other hand, the cheaper ones suffered from various limitations.

One solution is simply for the constructor to make his own, assuming that he is even moderately proficient with ordinary woodworking tools and plywood, chipboard, or hardboard. This approach has the advantage that, as well as costing less, it permits styling to suit individual taste, and provides good acoustic performance.

However, we did find one box which seems to satify most requirements. This is an auto extension speaker box complete with 125mm speaker, and the cost of the two combined is less than the price of many empty boxes.

It offers a professional appearance, a speaker mounting angle which is ideal for desk use, and room inside for the amplifier, battery and switch. The one we used is marketed by Davred, but there are other types available, some of them cheaper.

Some may be available with 4 ohm speakers. These will function satisfactorily as speakers, with the proviso that the rail voltage must be limited to nine. But be aware that, as microphones their output will be down by at least 3dB. The amplifier will probably cope with this, with a little to spare.

Those wishing to use 75mm speakers are not so well catered for. We selected a plastic box, with aluminium front panel, measuring 160mm x 96mm x 50mm, distributed by Instant Component services as type UB1.

Unfortunately it showed a tendency to rattle on sound peaks at certain frequencies. This rattle is between the aluminium front panel and the long edges of the box, which tend to bow outwards.

To alleviate this we drilled several pressure relief holes in the back of the box and fitted two small brackets at the centres of the longer sides, thus providing two more anchor points for the front panel.

Further acoustic improvement was provided by filling the boxes with as much Innerbond as we could comfortably fit.

Making up the printed board does not call for any special comment. Both the board pattern and the component layout are given and should make this part relatively simple. As always, watch the polarity of electrolytic capacitors and the lead configuration of the transistors — the latter particularly.

When the amplifier board is completed it should be tested and adjusted. Ideally this calls for a CRO and an audio oscillator, although an oscillator alone will allow some tests to be made.

Connect either an 8 ohm speaker or 8 ohm resistor across the amplifier output and an 8 ohm resistor across the input. Feed the audio oscillator into the input terminals and connect the CRO across the output load. It is also a good idea to monitor the current drain of the amplifier at the same time.

Set the 500 ohm pot towards the base of Q3, which should result in minimum current; around 15-16mA with no signal applied. Apply a low level sine wave and check the waveform on the CRO. It will almost certainly show crossover distortion and the pot should be advanced just enough to eliminate this, while maintaining the lowest possible current drain. A no-signal current of around 20mA would be typical.

In fact if no other means are available, the adjustment can be made on the basis of current readings, backed by the absence of audible distortion.

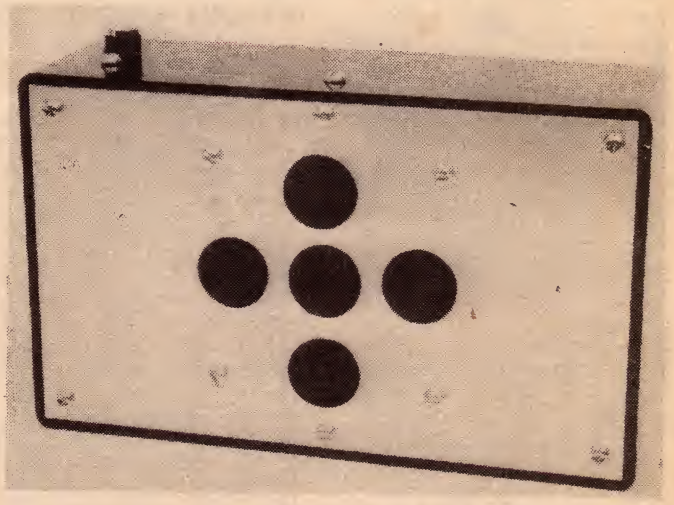
Now increase the input level until the waveform commences to clip. Ideally, it should clip equally on both halves of the waveform, or very nearly so. If not it may be necessary to adjust the value of the 150k resistor (1) in the base circuit of Q1. Increase or decrease this as necessary to produce symmetrical clipping.

If the AC voltage (RMS) across the load resistor can be measured, or calculated from the CRO pattern, the power output can also be calculated. This should be around 0.5W at the onset of clipping, for a 9V rail, and about 2W for an 18V rail. Current at full output can rise to 200mA for a 9V rail and this can be tough on a battery if you leave the amplifier run on full power tone for any length of time.

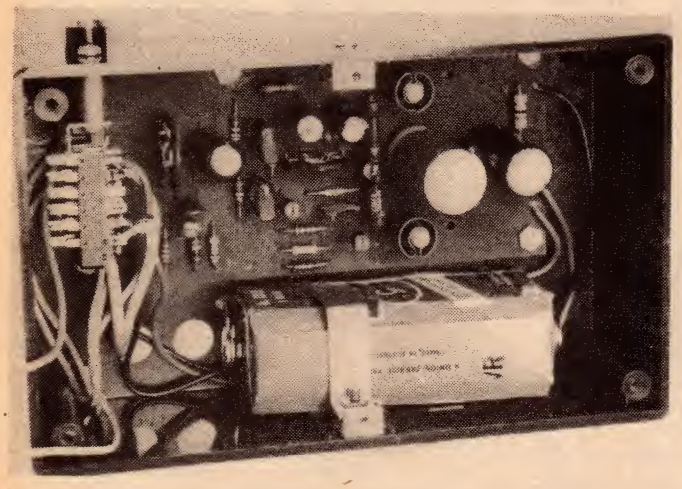
If it is intended to operate from an 18V rail it will be necessary to reduce the bias on the BC549 preamplifier stage, by reducing the 18k resistor (2) in the bias divider network. This should be reduced until the voltage at the collector is approximately equal to half the supply voltage. An 8.2k resistor should be close enough. As well as increasing the power output, the higher voltage will also increase sensitivity by a small but significant amount.

We mounted the finished board against the rear of the plastic case, using four 1/8in screws, each with an extra nut and washer as a spacer. Make

(Continued on page 123)



The alternative form of intercom, using 75mm speakers in a UB1 plastic box. Note the extra screws at top and bottom centre of the front panel to minimise rattle. The press-to-talk button is at the top left.



The UB1 box version with front panel removed. Note the switch mounting at top left and the extra brackets to secure the front panel. Packing the box with Innerbond provides some acoustic improvement.

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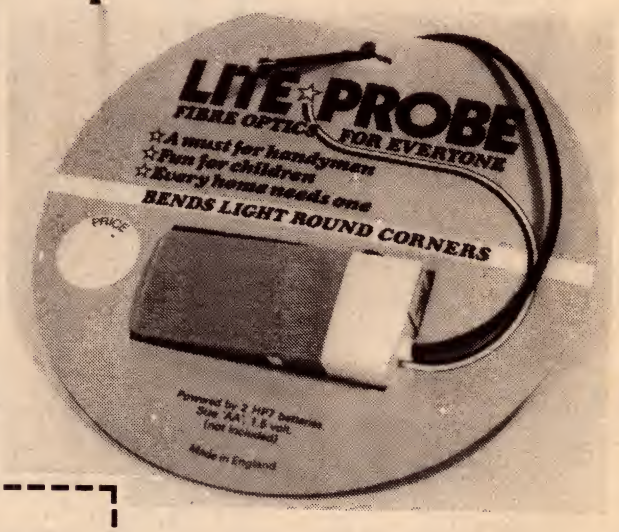

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Electronic thermometer comes as a kit

This attractively presented dual electronic thermometer should greatly interest those who need to take temperature measurements in two places at one. It features two scales, calibrated in Celsius and Fahrenheit, and is capable of measuring temperatures from - 40°C to +50°C. You can build it from a kit of parts.

by GREG SWAIN

Last month in the January 1977 issue, we described an electronic dual thermometer which had been developed in our laboratory. However, while this unit is quite suitable for the workshop, its appearance hardly made it an attractive proposition for the loungeroom.

It was with a great deal of interest, therefore, that we noted a similar unit in the recently released Tandy Electronics catalog for 1978. Branded "ArcherKit" and carrying the catalog number 28-4007, it is an indoor/outdoor thermometer kit featuring dual range scales, a large, easy-to-read meter, and push button controls. An attractive plastic case finished in simulated walnut completes the instrument.

The appearance of the completed instrument leaves little to be desired, making it quite suitable for wall mounting in the kitchen or loungeroom. The two meter scales feature yellow and white lettering against a black background, and read from —40°F to +120°F or from —40° to +50°C. Power is supplied by a single 9V alkaline battery.

As with the EA thermometer, the ArcherKit unit is a dual instrument capable of taking both indoor and outdoor readings. One sensor probe mounts inside the case for on-the-spot readings, whilst a second probe mounts outside (or in another room of the house) for remote readings. The desired reading is selected by means of the two push button controls on the front panel.

So how does the unit measure up as a kit of parts? And, more importantly, how does it perform when assembled?

The kit supplied to us for evaluation arrived carefully packaged in a cardboard box. Individual components are grouped and packed in plastic bags while the meter is protected by air-bubble plastic padding. A detailed assembly manual accompanies the kit, together with a small 8-page booklet describing the rudiments of kit building.

In fact, the accompanying literature is so detailed that we would venture to say that a rank beginner could successfully complete this kit!

Unpacking the kit and checking through the parts list revealed no missing parts. The kit was literally complete to the last nut and bolt, and contained adequate lengths of hookup wire and solder. The only part not supplied is the 9V battery, which must be bought separately.

Before going on to the assembly procedure however, let's talk first about the circuit. As you see, it is very simple.

Operation of the instrument is based on the change in forward voltage drop which occurs across a silicon diode when its temperature changes. This relationship between temperature and forward voltage drop across the diode is virtually linear, being of the order of —2mV/°C.

The instrument described here uses two series connected diodes in each sensor probe to give a change of 4mV for each 1°C temperature change. By applying these voltage changes to a sensitive meter movement, suitably calibrated, we can thus determine the temperature of the probe. Refer now to the circuit diagram.

Both indoor and outdoor temperature measurements are possible with the ArcherKit electronic thermometer.

Transistors Q1 and Q2 provide a constant current to the zener diode which in turn, provides a fixed voltage reference for the sensor bridge. This bridge is made up on one side by the calibration trimpots VR1 and VR2 and associated series resistors, and on the other by the sensor probe diodes and the 5.6k resistor.

A sensitive meter is used to monitor the two sides of the bridge. Any changes in voltage across the sensor probe diodes as a result of temperature changes will thus be reflected in the meter readings.

The two pushbutton switches have three functions: to switch the battery in and out; to switch the meter to the appropriate wiper of the calibration trimpots; and to select either the indoor or the outdoor sensor probes.

In practice, VR1 and VR2 are set so that the meter reads 0°C or 32°F with the sensor probes immersed in ice-cold water. VR3 is basically a sensitivity control and is adjusted so that the outdoor reading agrees with a reference thermometer, with both the outdoor sensor probe and the reference thermometer in hot water. The exact procedure is set out in some detail in the assembly manual.

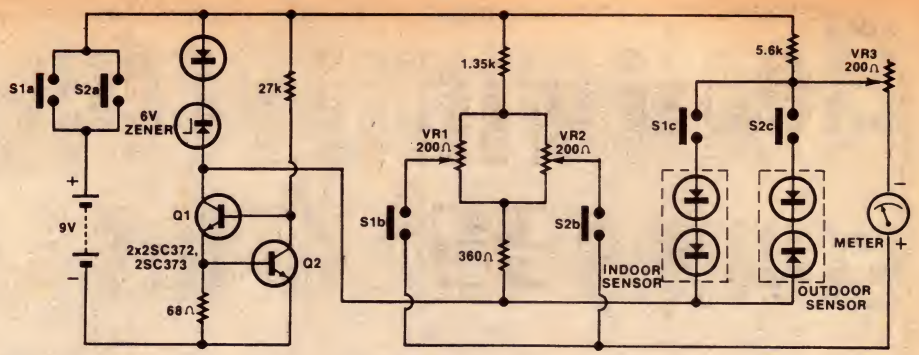
About the only component which we haven't mentioned so far is the silicon diode in series with the zener. It's purpose is to provide temperature compensation for the regulated supply, or more accurately for the zener diode.

Assembly of the unit is a straighforward exercise. The main job has to do with assembling most of the various components onto a small PC board, and interconnecting it with a wiring cable to the two small switch assemblies. This done, the meter and the battery holder are glued into position in the plastic case (glue supplied) and the assembly left for about an hour for the glue to set.

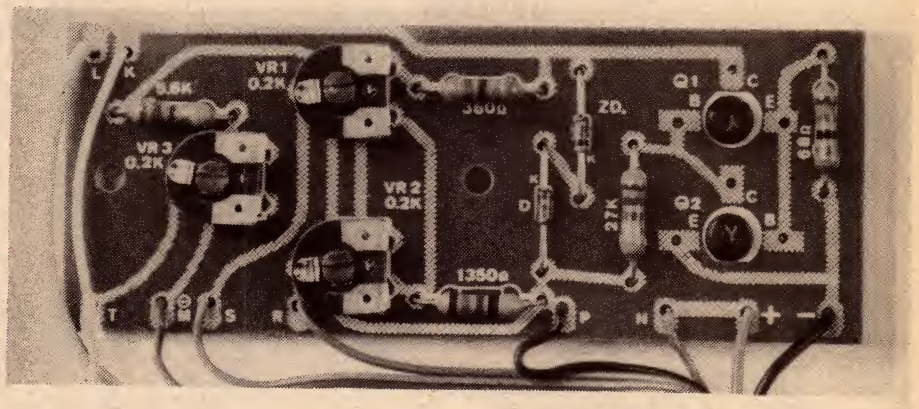
It is then simply a matter of dropping the wiring assembly into position in the case, as shown in the photograph. The two switch assemblies are held in position by self tapping screws, while the main PC board mounts on two plastic spacers on the back panel. Holes in the back panel provide access to the calibration controls mounted on the main PC board.

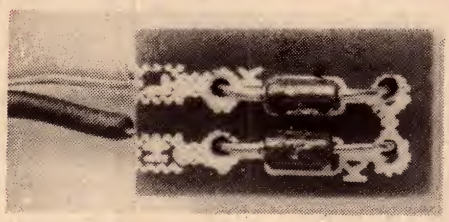
All that then remains to do is to assemble and wire in the sensor probe assemblies as described in the assembly manual, and carry out the calibration procedure. We found the calibration procedure a relatively simple matter, and had little difficulty in putting our unit into operation.

There are a few hassles though, mainly to do with the switch assemblies. These employ a rather crude arrangement whereby three leaf spring assemblies are forced against three eyelet contacts on the switch PC boards whenever a switch button is pushed. The results of this arrangement are not entirely satisfactory.

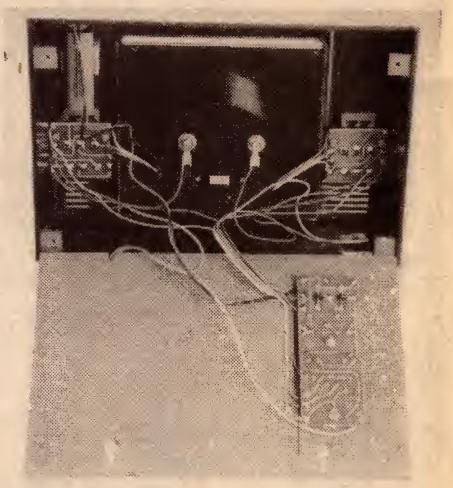


Above is the circuit diagram of the ArcherKit Indoor/Outdoor Electronic Thermometer, redrawn EA style. Below is the assembled PC board.





A close-up shot of one of the sensor probe assemblies. The outdoor probe is fitted into a small metal cylinder for weather protection.



Right: Inside view of the completed instrument. Assembly is a relatively straightforward exercise.

In practice, the switches tend to be "noisy", and a certain amount of fiddling with the leaf springs is required to achieve reliable readings. And another problem — if the switches are not pressed cleanly in the centre, the meter will sometimes travel backwards, and stick. Some judicious finger tapping is then required to free the meter!

However, provided one is prepared to spend a little care in setting up and operating the switches, reliable readings can be obtained.

At this stage you are probably wondering what sort of money is involved, and what provisions there are if the kit doesn't work.

Well, the kit costs $29.95 and is available from, or can be ordered through, your nearest Tandy store. Alternatively, you can order through the mail from Tandy Electronics, PO Box 229, Rydalmere, NSW 2116. The mail order surcharge is $2.50

If the completed kit does not function correctly the first step is to follow through the troubleshooting proceedure described near the back of the assembly manual. Failing this, you can take advantage of the warranty and repair service offered by Tandy, the terms of which are set out on the back page of the assembly manual.

One final point. The back panel of the instrument features two "key-hole" shaped holes designed to enable the unit to be hung on a couple of screws screwed part of the way into a wall. Mounted in this fashion, the ArcherKit electronic thermometer would make quite an attractive wall unit.

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An electronic Morse code keyer

This electronic Morse keyer is easy to make and all components are available on the local scene. It uses virtually "state of the art" techniques and it should be an interesting project for CW enthusiasts.

by IAN POGSON

One only has to tune the HF amateur bands to realise that the transmission mode most used is single sideband (SSB), either upper or lower sideband as required. Other modes are also used of course, including AM, NBFM, RTTY, etc. Oh yes, I nearly forgot, CW or Morse code is still also used by quite a large number of enthusiasts. The same comments could also apply to the VHF amateur bands, with the emphasis somewhat less on SSB and perhaps more on FM, but there are still the followers and users of CW.

There is a lot to be said for the use of the CW mode of transmission. In its simplest form it requires a minimum of equipment and with even low power, quite often a signal can be got through where all other modes fail. There is also a fascination for CW which is difficult to explain, but is experienced by those who use it. Enough of that however. I do not intend to enter into a discourse on the pros and cons of the various modes. Suffice to say, the use of CW is also keeping up with the state of the art, along with the others.

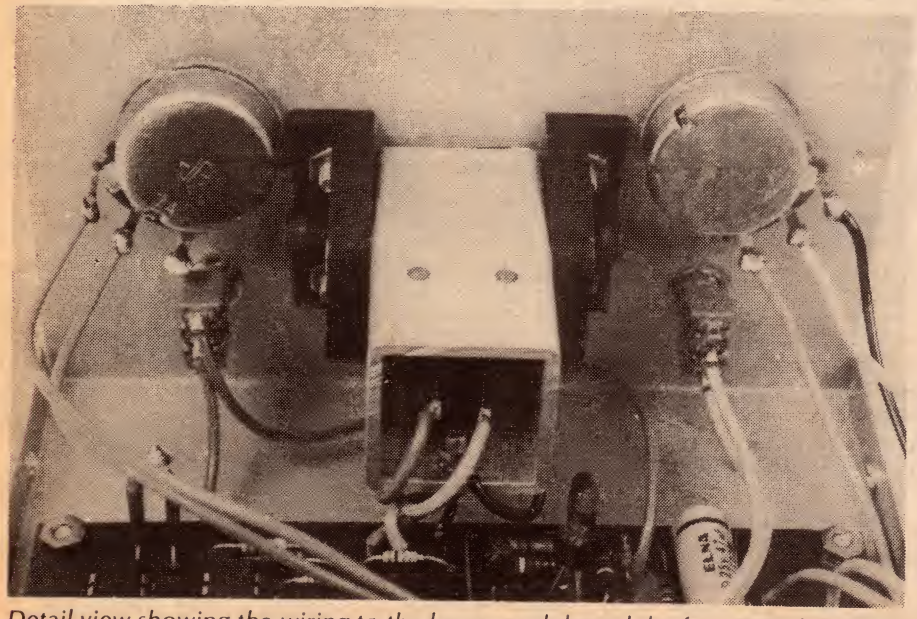
In earlier times, Morse code was sent by means of the ordinary hand key which is familiar to most of us. Then other types of keys were developed. Some of these were semi-automatic and others somewhat more elaborate types, all mechanical, and the method of use was usually by sideways motion of a handle or paddle. These devices were all capable of excellent results.

More recently, with digital techniques being available, various electronic keyer circuits were devised. By suitable design, it then became possible to form the Morse characters virtually to perfection. All the operator then had to do was to learn to drive it! I have had a go at sending with such a keyer and while it seemed rather tricky at first, it did not take very long to get the hang of it. Although the sending was slower than might have been done with the ordinary key, the results were as one could expect. Obviously, further practice would result in higher speeds.

In the American amateur radio magazine QST for August, 1973 appeared an excellent keyer design by James M. Garrett, WB4VVF. It made use of the 7400 series TTL devices, and I made one up on "Proto" board. It worked as expected straight away. However, the TTL devices are rather hungry with respect to current and a further article in QST for January, 1976, described how the keyer could be made up using the pin-compatible CMOS 74C00 series of ICs. This reduced the current consumption dramatically and to such a low level that a small battery could be used, and still last for many months.

I modified my Proto board accordingly and fitted the appropriate CMOS devices. The results were again up to expectations. Encouraged thus far, I decided to make up a printed board which would be available readily to readers in this part of the world. Before doing so however, a number of outstanding points had to be cleared up. The board made by the original designer was adequate for the TTL version but some modifications to the circuit for CMOS require that some extra resistors and connections had to be made directly to the copper tracks on the board. Also, a monitor oscillator would be desirable for the new board.

A commonly used audio oscillator for Morse practice, etc., using a 555 timer IC and capable of driving a loudspeaker was chosen as being ideal for this purpose. And so a PCB was worked out which included the modifications for



Detail view showing the wiring to the keyer module and the front panel controls.

CMOS and also including the audio oscillator. This makes it very easy to make up the keyer, as the board is simple to assemble and then only has to be fitted into a suitable box, along with the paddle, battery and controls.

The circuit may be conveniently divided into four sections. In describing the sections I will use the same terms as used by the original author.

The non-synchronous section consists of the paddle, next-dot memory (IC1A & B), next-dash memory (IC2C & D), initial dash (IC1C), initial dot (IC2A) and the iambic gate (IC1D & IC2B). The synchronous section consists of the clock (Q1 & Q2), present-dash memory (IC3A), present-dot memory (IC3B), counter (IC4, IC5A & IC7A), missing-bit detector (IC6B, IC6A & C), dash start-stop gate (IC6B), dot start-stop gate (IC6D) and the OR gate (IC7B).

The output section consists of the output driver (Q3 & Q4), and the monitor (IC8). The power supply consists of a 9V battery and a filter circuit consisting of a 47 ohm resistor, a 15V zener diode and a 47uF electrolytic capacitor. The filter is included as a precaution against any possible spikes which may find their way into the supply.

The finished article includes a number of controls and facilities for the operator. The battery on/off switch can be disposed of quickly. The clock has a speed control which is adjusted to suit the sending speed of the operator. A volume control is provided to adjust the monitor volume to suit the operator. Also, a tone control is provided to adjust the audio frequency of the monitor. A tune switch is also provided so that the transmitter may be keyed on while tuning and adjustments are made. In parallel with this switch, is a socket making it possible to use an ordinary hand key for keying the transmitter.

An interesting feature of the keyer is the provision for automatic character spacing. A dot has a definite length as set by the speed control and the spaces between dots and dashes are equal to a dot in length. A dash is equal to three dots. With proper sending, the Morse characters will have the correct proportions. However, without the automatic character spacing, the spaces between characters will be determined by the operator. With the automatic facility, the spacing between characters will be equal to three dots, provided the operator operates the paddle for the first part of a new character within this time.

Finally, we have a socket which is the keyer output and which is run via a coax cable to the transmitter to be keyed.

As mentioned earlier, there have been previous articles describing this keyer. Also a printed board was made available in the United States, but this would not have been readily available to prospective builders in Australia. We have had the advantage in that we have been able to modify the board where desirable and in addition, to incorporate the monitor circuitry on the same board.

Apart from the addition of the monitor of our choice on the board, modifications to suit the CMOS devices have also been included. These consist of connecting pin 4 of both IC4 and IC5 to the supply rail. Also, a 10k resistor is added to pin 1 of IC1A, pin 9 of IC2C, pin 13 of IC5B and pin 5 of IC7B. The other end of each resistor is connected to the supply rail. Although it was not included in the article in QST describing how CMOS devices could be used, we found that the inputs of the third and unused gate of IC7 were left floating. This did not effect the operation but it did take unnecessary battery current. Pins 9, 10 and 11 of IC7 are automatically grounded on our new board.

Because the types originally specified do not seem to be readily available here, we found it necessary to substitute for the transistors in the clock and the output circuits. We have used BC548s instead of the 2N2222, a BC558 for the 2N2907, and a 2N5401 for the 2N4888. These functioned quite satisfactorily.

The Vceo rating of the 2N5401 is 150V and this should be adequate for most requirements, at least up to a key-up voltage of about —100V. Above this, it

PARTS LIST

1 Metal cabinet 134mm wide x 76mm high x 150mm deep (see text)
1 Metal bracket for battery
1 Printed board 121mm x 71mm code 78EK3
3 Knobs
1 Paddle (see text)
1 Battery 9V Eveready No 2362
3 SPDT miniature toggle switches
2 RCA sockets, single hole mounting
1 Miniature loudspeaker, 57 mm (2.25in) with 8 ohm VC
2 Transistors, BC548 or similar
1 Transistor, BC558 or similar
1 Transistor, 2N5401
1 Silicon diode, 1N914
1 Zener diode, BZX79C15
1 IC, 555 timer
3 ICs, 74C00 quad 2-input NAND gate
3 ICs, 74C74 dual type D flip-flop
1 IC, 74C10 triple 3-input NAND gate

RESISTORS
(½W unless stated otherwise)

1 22 ohms	*2 5.6k*
1 47 ohms	*1 8.2k*
1 150 ohms	*4 10k*
1 470 ohms	*1 100k linear pot*
2 1k	*1 270k*
1 1k linear pot	*1 1M linear pot*
1 2.2k	*1 2.2M*
1 4.7k	*2 3.9M*

CAPACITORS
3 .001uF greencaps
1 .022uF greencap
1 .047uF greencap
5 0.1uF greencaps
2 47uF 25VW electros

MISCELLANEOUS
Hookup wire, solder, screws, nuts, coax cable and plugs as required.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.

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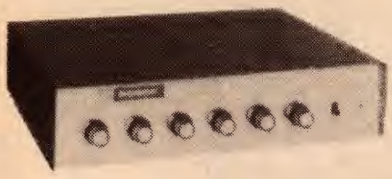

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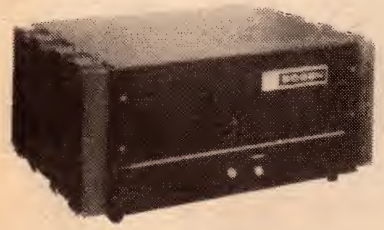

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Electronic Morse Code Keyer

would be wise to seek out a transistor with a suitably higher voltage rating. Alternatively, it should be possible to introduce a relay which will cope with the higher voltage.

While all of the components should be available to builders, a few comments may be helpful. The most important item and the one which may take a little seeking out, is the "dual paddle squeeze key", to give it its full title. The one which we used came from New Zealand. Details were given in "Break-In" for July, 1977.

There are other possible sources of suitable keys, although I should stress that our electronic keyer has been arranged physically to take the New Zealand key. Other keys, while they would do the job adequately, may call for a somewhat modified physical arrangement. Some keys are designed to be used as a seperate unit and external to the electronic keying circuitry. Two places are suggested as possible sources of suitable keys, both in the United States. They are: Wm. M. Nye Company Inc., 1614 130th N.E., Bellevue, Wash. 98005, and MFJ Enterprises, P.O. Box 494, Mississippi State, MS 39762.

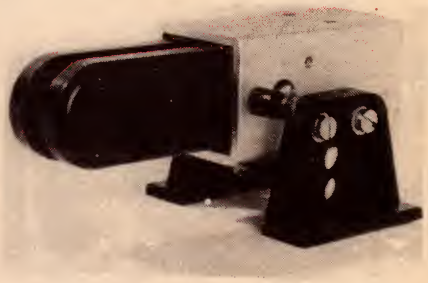
The box which is used to house the electronic keyer was obtained from Dick Smith Electronics and supplies should be readily available from this source directly or possibly through your local supplier. The miniature 57mm (2.25in.) loudspeaker was also obtained from DSE.

The printed board was supplied by RCS Radio Pty Ltd and supplies may be obtained either directly or through your local supplier. Supplies of boards may also be available from other manufacturers. Transistors have already been touched on and no problems should be experienced with them. The 74C00 series of ICs are made by National Semiconductor and again, no trouble should be experienced in obtaining all types required.

While there is quite a full printed board, construction of the complete unit was not difficult. However, some precautions must be observed to avoid possible damage to vulnerable components. As CMOS devices are used, care should be taken when soldering them into circuit. The barrel of the soldering iron should be connected with a clip lead to the earth part of the copper on the board. Also the + supply and earth connections should be made first to each of the ICs as they are fitted. In addition, the usual precautions should be taken not to overheat components when they are being fitted.

There are two schools of thought relating to the use or otherwise of sockets for ICs. If you do not use sockets, then the precautions listed above naturally apply. However, if you elect to use sockets, then they may be soldered to the board without any particular precautions. When all soldering is complete, then the ICs may be plugged into the sockets. You will

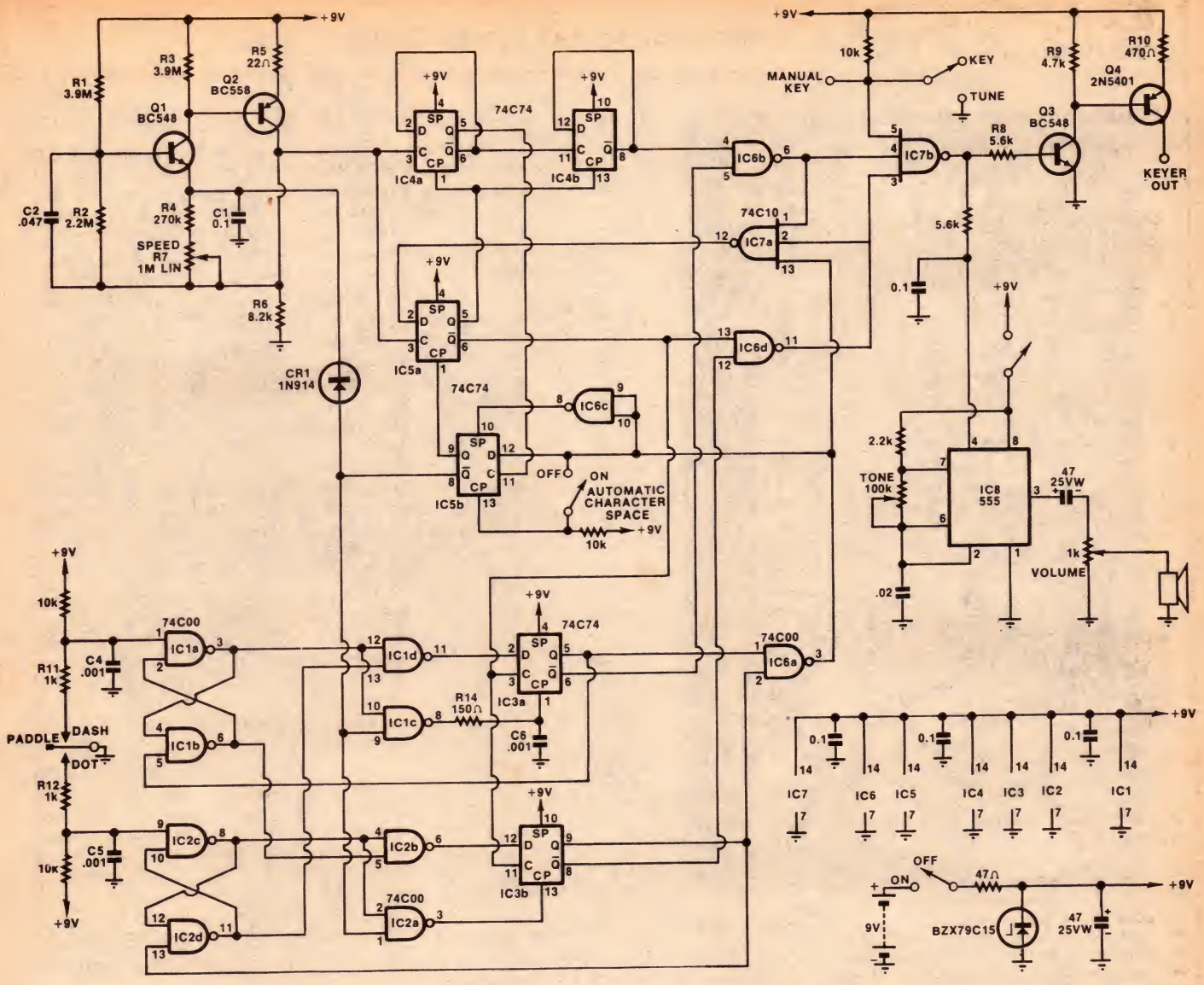
Simple, robust keyer paddle from NZART



The "Gailbraith" keyer paddle, GK1, used in the accompanying project, is marketed by the Christchurch Branch of the NZART. The paddle arms and the mounting brackets are cast in black plastic, and the body is extruded aluminium with anodised finish. Silver contacts are riveted to phosphor-bronze leaves in the paddle arms. The common contact is a silver-plated pillar between the paddles.

The mounting brackets may be rotated to suit either chassis or panel mounting and the tension on the paddles may be varied by selecting one of three positions for a small coiled spring between the paddles. The movement of the paddles is also adjustable by means of knurled screws protruding from each side of the housing. Together, these adjustments provide a wide range of "feel".

The GK1 is available, built and tested, for $NZ15.00, plus $NZ1.00 air mail post and packing to Australia. Spare parts are also available in the unlikely event that they will be needed. All enquiries should be directed to: The NZART Christchurch Branch Inc, Projects Group, PO Box 1733, Christchurch, NZ.

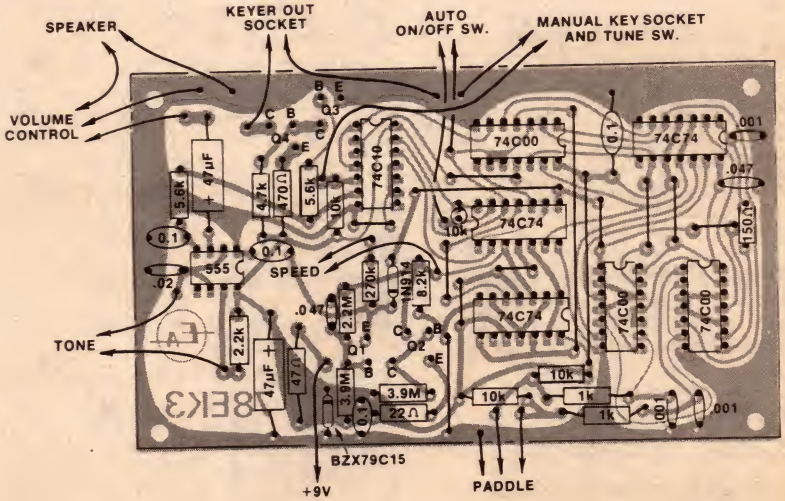


ELECTRONIC KEYER

notice from the pictures that I used sockets. The main reason for this was to allow me to use either CMOS or TTL devices, without the annoying job of having to unsolder a large number of connections.

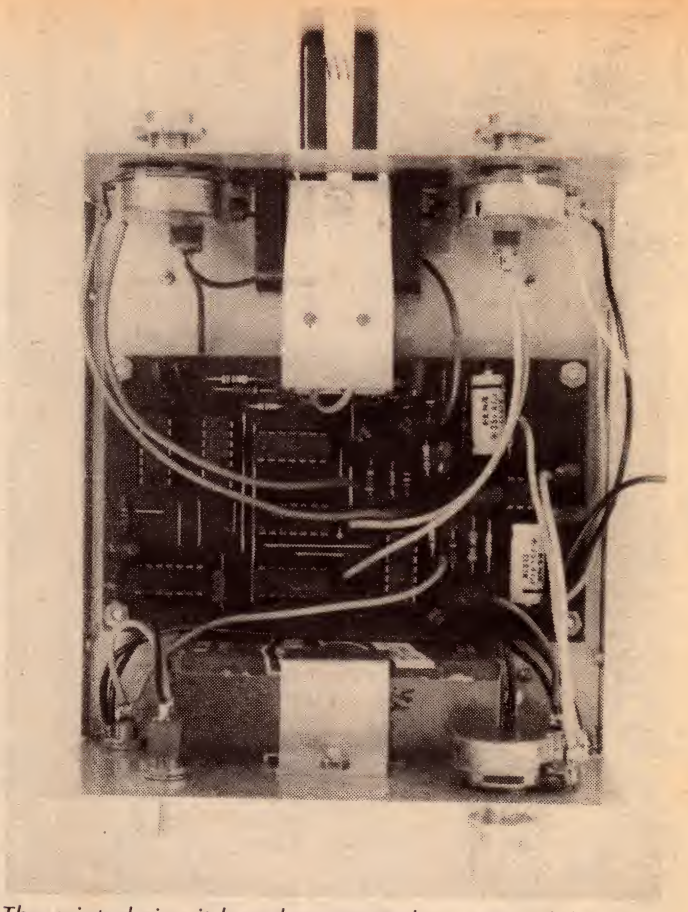
When assembling the board, I suggest that you start with the links, of which there are quite a number. Then all of the other small items such as resistors, capacitors, etc., are added, finishing with the ICs or sockets. There are also a number of leads which run from the board to other parts of the box and these should be added, with sufficient length in each case to reach its intended termination.

You will need a bracket to hold the battery in place. This can be seen in the picture and I made mine from a small scrap of 18 gauge aluminium. Four holes have to be drilled in each of the back and front panels. In addition, a square hole must be cut out of the front panel to take the key assembly. Assuming that you are using the New Zealand



This wiring diagram shows the PC board as viewed from the component side. When assembling the board, leave the CMOS devices until last and then observed the following precautions: earth the barrel of the soldering iron with a clip lead to the earth pattern on the board, and solder the power supply pins of the ICs first.

Electronic Morse Keyer



The printed circuit board accommodates most of the components.

◀ *At left is an actual size reproduction of the PC pattern, shown from the copper side.*

key, the hole which we cut was 21mm square, with four screw mounting holes to suit.

In addition to all that hole cutting, you still need four holes to mount the board and one hole at the back to fix the battery. All this done, you are now ready to assemble the various items into the box and connect up the various leads from the board to the pots, switches, etc.

I used RCA sockets on the back panel for the "keyer out" and "manual key". These are quite satisfactory, but some readers may wish to use other types.

The unit is almost complete, except for mounting the miniature speaker on the side of the box cover. On the box which I used, there are ventilating slots on each side. Fortunately, use can be made of these to mount the speaker. I used four 1/8in Whitworth screws, passed through appropriate points and then put a nut on each on the inside, such that the speaker outer edge was just a snug fit between the nuts. This adjusted, the nuts were tightened. Flat washers were then dropped over each screw and more nuts fixed the speaker firmly in place.

This completes the keyer and it is virtually ready for use. It is simply a matter of adjusting the various knobs etc., to give the desired results, as far as the keyer proper is concerned. However, it will depend upon the actual requirements for keying the particular transmitter as to just how it will be interfaced with the transmitter. The output circuit shown is for negative grid-block keying. Where other methods of keying, such as cathode keying, may be desired, then I suggest that reference to the original article and to the ARRL handbook be made. The use of coax cable is a must.

It is also worth noting that with quite a number of modern tranceivers, a built-in monitor oscillator is provided. If this is so in your case, then the monitor already provided on the board may be omitted.

Having built the electronic keyer and mastered its use, perhaps you may be interested in adding a memory to give the ultimate touch to the device. If you have access to the 1977 edition of the ARRL Handbook, then I suggest that you have a look at the article beginning on page 359.

The rear panel of the Electronic Morse Keyer. RCA sockets were used for the "manual key" and "keyer out" input/outputs.

The Serviceman

Colour TV servicing — Is it the nightmare we feared?

Do the stories I relate in these notes give a false impression of what servicing is all about? Some colleagues feel that I put to much stress on the difficult and unusual faults, whereas the bulk of service work is fairly routine. Well, to balance things out, here are some routine faults taken from a colleague's case book.

In the August 1976 issue I presented some thoughts by a colleague on colour servicing at that stage of the colour scene. More recently we had another long discussion on how we had settled down to handling colour sets. I think that his comments sum the situation up pretty well, and are worth repeating.

"It is now over two years since I commenced servicing colour TV sets and, in the light of experience over this period I find that 95% of my colour TV service calls are just routine. Sure, I get caught for a while with the odd one; but these are the exception rather than the rule.

"What I said then about test equipment still goes — a colour bar pattern generator, a good multimeter, and a degaussing wand are ample to take on home service calls. However, I have my eyes on one of the small DVMs — could save space in the toolkit. A similar setup is suitable for the workshop although I find a CRO handy on occasions.

"Another point to appreciate is that both the equipment and experience which you acquire for colour TV servicing will also stand you in good stead for servicing solid state monochrome TV sets. After all, half the job of learning to service colour sets was learning to work with solid state circuitry. Apply these techniques to monochrome sets, and you will be surprised how quickly you get through them.

"I have also found through experience that foreign colour sets are not that much more difficult to service than the brands with which I am more familiar. Colleagues have complained about difficulty in obtaining spares for imported sets, but so far I have been able to get the parts required — or suitable substitutes — touch wood. Apply a little commonsense when servicing these sets and you won't have much difficulty."

My colleague also felt he could best make his point by doing what he did on the previous occasion: listing a series of brief stories typical of routine faults. Unlike me, he prefers writing about this kind of fault. In fact, he sometimes criticises me for featuring only the "hard ones".

"You make it sound too difficult. Servicing isn't all intermittents and sets that other blokes have failed to fix. You know as well as I do that it's mostly routine faults; and that it's the routine faults that put the fruit on the sideboard. Let's balance things out a bit."

He's right, of course. It is the routine faults that pay the bills. It's just that I never regard them as very interesting or found them easy to write about. So, for a change, here are his impressions of typical service jobs:

(1) Rank Arena 22in. No picture or sound. Blown fuse. It was a 500mA fuse of a non-standard type and unfortunately, I didn't have one with me. However I was in luck; the printed board is so designed that the fuse clip could be unsoldered and placed in a niche further along the board, to enable a standard 3AG fuse to be fitted. This done, and a new fuse installed, the set worked like a charm. A phone call a fortnight later confirmed everything OK.

(2) Philips K11. "Hiccupping." HT from mains rectifier only 250 V instead of 340V. Voltage on positive lug of main filter capacitor nil. Resoldered dry joint where filter capacitor should make contact with the printed board. Another one working.

(3) Pye T29. The owner had recently moved into the area and, since moving, found that the set was losing colour intermittently and what colour there was, was desaturated. In view of previous experience with this model, I went for the ACC (Automatic Chominance Control) pre-set pot. Turning it a fraction brought the set back to normal. However, I noticed that the setting was quite critical, so I carried out a modification recommended by Pye. This consists of changing R306 from 56k to 120k, and adding a 33k resistor in series with the ACC pre-set pot. After carrying out this modificationn adjustment of the ACC pre-set was much smoother. About a month later, the customer dropped a radio in for repair, and reported that the colour set was 100%.

(4) Philips K11A. No luminance. Suspecting the video amplifier section, I measured the voltage at test point M25 — video output transistor, collector — and found it to be about 200 V instead of 115V. Evidently the transistor wasn't conducting. I next checked the base of the output transistor and read about 4V instead of 5.6V. I decided to take a punt on the video pre-amp transistor TS291- a BC548C- as I have had a high failure rate with these types. A replacement cured the trouble and the set was again working perfectly.

(5) HMV Courier (Decca 33 Chassis). No picture or sound. After removing the rear cover I noticed that two spring loaded resistors (R82 and R465) had "popped". I re-soldered them and switched the set on, and was rewarded with picture and sound. However; I was suspicious, as it was most unlikely that these two safety resistors would have "popped" for no reason.

I commenced with the audio output stage as it was already showing signs of distortion. I measured the cathode bias on the PCL82 audio output valve, and instead of 17V it read 25V— and climbing rapidly. Out came the faulty PCL82 and in went a new one.

However, before leaving it, I changed the cathode bias resistor from 390 ohms to 470 ohms, and the grid resistor from 470k to 220k. This has little or no effect on performance, but should prolong the useful life of the PCL82. Having fixed that, I began looking for other likely faults. At this point a customer walked in, and when I returned to the set about 10 minutes later, I noticed that the colour had vanished. A few minutes later the picture lost horizontal hold. Experience has taught

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me that the most likely cause was the PCF802/9JW8 horizontal oscillator valve. I fitted a new 9JW8 and let the set run on "soak" for the rest of the day before returning it. A phone call a week later confirmed everything OK.

(6) Philips K11A. Little or no green picture. This was confirmed with a colour bar generator — the green bar being very dark and not varying with saturation. Again through experience, I suspected the BF337 G-Y colour difference amplifier. A quick check of the collector voltage read 200 instead of about 130. Replacing the transistor confirmed my suspicion, and returned performance to normal.

(7) Pye T29 chassis. No picture or sound. A quick check revealed that both mains fuses were blown; obviously a short somewhere. My first pick was the two sets of bridge rectifier diodes in the power supply. Sure enough, two of these diodes, D401 and D402, had broken down. As I did not have exact replacements, I fitted four OA626/400's. The set then worked, but it appeared to have intermittant loss of AGC. A quick check showed that ICI was very touchy so I removed it and sprayed the socket contacts with "Serviceman's Friend" and refitted the IC. This cured the trouble, and the set turned in a good performance.

(8) HMV C211 chassis. No sound. The set was a console type, so I was hoping for something simple, as I did not want to cart it back to the workshop. Luck was with me — a quick check with signal injector to the input of the audio IC gave no output. A quick check of the speaker with the ohmmeter cleared the speaker, and another quick check showed that about normal voltages were being applied to the audio power amplifier IC. I fitted a new IC (MC1316P) and the sound came through loud and clear.

(9) HMV Galaxy (Decca 33 series). No picture. A quick check showed R465 had "popped". Re-soldered same and the set came good. After a few minutes it lost colour and then horizontal hold. Fitted another 9JW8 and took my leave.

(10) AWA 4KA chassis. No sound. As this one was also a console and as it was my last call for that day, I tried a new audio IC first up. It paid off — sound came through loud and clear.

(11) Pye T29 chassis. No colour. First I tried the ACC control pre-set, but no go. Next I measured the voltage across D36 which rectifies the PAL ident signal and applies forward bias to the colour killer. Instead of reading around six volts, it was zero. A quick check with a CRO confirmed that there was no ident signal. Not wanting to waste time, I decided to replace the two BC548 transistors in the ident circuit. My decision was influenced by their low price and the fact that I had experienced trouble with these transistors in the past. The idea paid off; after fitting the two BC548's normal colour returned.

(12) Precedent 22in. No picture or sound. Mains fuses checked OK, also primary of power transformer, switch and power lead — but no complete circuit. Closer inspection revealed a loose fuse clip, which had caused intermittant arcing and , in turn, corrosion of the inside of the clip. A quick clean and tightening of the fuseholder, and the job was done.

(13) Philips K9A. No pix or sound — but ticking noise coming from inside of set. Again I was hoping for a quick cure, as this one was a "wideboy" and I didn't relish carting it back to the workshop. Again calling on past experience, I disconnected the lead going from the tripler to the line output transformer and produced sound. A new tripler and the set was back in business.

(14) Pye T29. Desaturated colour. Again I went for the ACC pre-set and again the colour came back to normal. I again modified the ACC circuit and reset the ACC pre-set, and the job was done.

(15) HMV Courier. No picture. Sound would be present for a few minutes — then the overload cut-out would "pop". I removed the back and switched on, and after about a minute the PY500 damper diode started to glow red. When a new one did the same, I checked the B+ boost capacitor — and found it shorted. A new one fixed it.

(16) Philips K11A chassis. No picture or sound, set "hiccupping." Another dry joint where the filter capacitor connects to the printed board.

(17) HMV 14in. portable. Snowy picture with no colour. Hooked it up in the workshop — nothing wrong. The owner asked me to call at his home the next day and have a look. Sure enough, it was as he described it. He was in a bad reception area and had connected it to an outside antenna. As soon as I looked at the antena terminals on the set, the trouble was obvious — he had connected the antenna to the UHF terminals. Connecting the antenna to the VHF terminals gave good clear colour. We both had a good laugh.

(18) Philips K9A. No picture or sound. I measured the B+ voltage at test point M30 and found about 30V instead of 145V. Past experience has taught me that the most likely cause is a C to E short in one of the line output transistors, and sure enough it was. Replacing it restored picture and sound.

"Well, this is a good selection of colour sets I have repaired recently. Easy as falling off a log, isn't it?"

Yes, perhaps it does sound easy. Perhaps I could accuse my colleague of the opposite fault; making it all sound too easy.

In fact, I don't think any of my readers are likely to be deceived either way. Sure it isn't all intermittents and head scratching; but it isn't all routine faults either. You have to learn to take the good with the bad.

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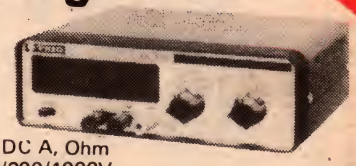

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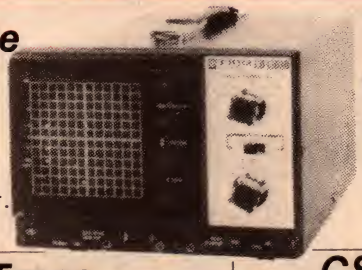

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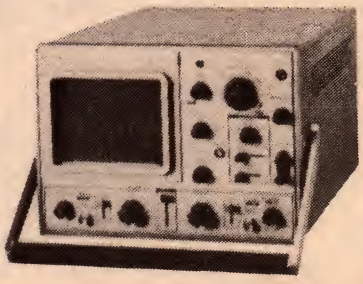

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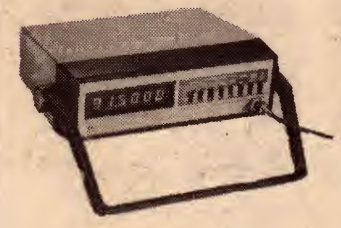

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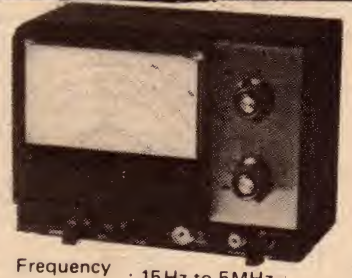
Voltage range	: DC: 0.5V to 1,500V f.s. in 8 ranges AC: 1.5V to 1,500V rms f.s. in 7 ranges 4.2V to 4,200V p-p f.s. in 7 ranges
Input, R, C	: DC: 11MΩ AC: 1MΩ, 145pF at 1.5V to 150V ranges 1MΩ, 80pF at 500V to 1,500V ranges



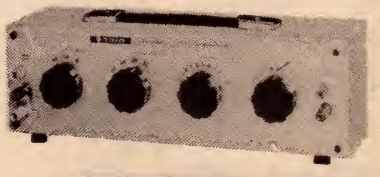
Frequency range	: 15Hz to 5MHz
Ohm range	: 0.1Ω to 1,000MΩ in 7 ranges Batt. operation: 4 x UM3's, 1 x UM1
Power	: AC operation: AC 100/117/230V available with AD-108

$ 19.00
$ 21.85 inc. S.T.

RA920 Resistance Box

Attenuation Range:	0 ~ 121 dB Attenuation in Steps of 0.1 dB
Frequency Range:	DC ~ 1 MHz
Max. Input Level:	+27 dBm, 0.5W or 17Vr.m.s.

$254.00
$292.10 inc. S.T.



TRIO

If you want professional results — get pro

SIGNAL GENERATORS

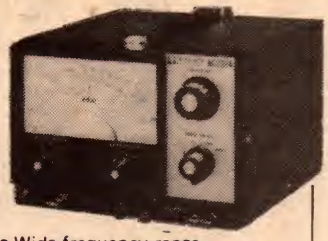
SG402 R.F. Signal Generator

- Wide frequency range
- Compact
- Amplitude modulation facility

Frequency range	100kHz to 30MHz in 6 ranges
Output voltage	0.1 V rms
Int. Mod.	400Hz, 40% modulation
Ext. mod.	1.5V rms, 50Hz to 10kHz

$ 99.00
$113.85 inc. S.T.

AG202A CR Oscillator



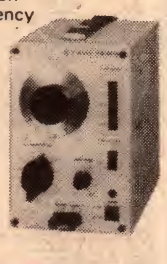
- Wide frequency range
- Sine and square wave signals
- High output stabilized voltage

Frequency range	20Hz to 200kHz in 4 ranges
Output impedance	600Ω
Output voltage	Sine wave: 10V rms, Square wave: 10Vp-p
Sine wave distortion	0.5% (50Hz to 100kHz)

$135.00
$155.25 inc. S.T.

AG203 CR Oscillator

- Wide frequency range
- Sine & square wave signals
- Low distortion
- Stable frequency response



Frequency range: 10Hz to 1MHz
Frequency response: ±0.5dB
Distortion: Less than 0.1%
Output voltage: Sine 7Vrms, Square 10Vpp
Output impedance: 600Ω
Attenuator: 10dB x 6

$232.00
$266.80 inc. S.T.

SM301 FM,MPX Stereo Generator

- High separation value
- FM MPX emissionable
- Handy

Channel separation: 40dB: 100Hz to 10kHz
Int. mod. freq.: CH L: 1kHz, CH R: 1kHz and line frequency
Ext. mod. freq. range: 50Hz to 15kHz
Pre-emphasis: 50μS, 75μS
Output impedance: 600Ω
Pilot frequency: 19kHz ± 2Hz
Sub-carrier suppression: 40dB

$249.00
$286.35 inc. S.T.

MODEL E200D RF Signal Generator.

- Built-in 100kHz and 1MHz crystal calibration system
- Easy-setting 2-color 5" anti-backlash vernier dial
- 100kHz to 54MHz coverage in 5 fundamental bands and harmonics to 216MHz
- Completely shielded RF output with modulation percent metering and variable monitored attenuation usable to less than 1μV

$299.00
$343.85 inc. S.T.

Sine/Square Wave

MODEL **E310B**

- Extended frequency range: Sine: 20Hz to 2MHz Square: 20Hz to 300kHz
- Constant-voltage output over each band and band-to-band
- 56dB step attenuation
- 2% calibration accuracy
- 7VRMS output into high impedance loads

$249.00
$286.35 inc. S.T.

MODEL 1040 CB Servicemaster

- Greatly simplifies all CB transceiver servicing
- Checks complete CB transceiver performance in minutes
- Checks AM and SSB transceivers
- No complex hookups or calculations required
- Test results displayed on direct reading meters
- Only one hookup required for all tests
- Eliminates need for special equipment

$282.00
$324.30 inc. S.T.

MODEL 2040 PLL CB Signal Generator

- Designed for use with all class D CB transceivers...AM and SSB.
- ±5 parts per million accuracy guaranteed, ±1ppm typical.
- Delta frequency adjustment allows variation from channel center frequency for SSB performance tests and bandpass filter evaluation.
- Built-in EIA standard noise generator to check automatic noise limiters and noise blankers.
- Internal modulation frequencies of 400, 1000, and 2500 Hz.
- Crystal controlled 455kHz IF. Output attenuator and vernier provide calibrated outputs from 100,000 μV to 0.1 μV.
- Double shielding eliminates spurious radiation.
- Ultra-stable...phase-locked loop circuitry and oven-controlled crystal assure stability.
- Performance compares to much more costly generators.

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$615.25 inc. S.T.

B. TEST GEAR

PF810 Power Meter

Effective Radiated Power: Directly Readable
Antenna Selector: Built in
Measurable Ranges: 1.8 ~ 200 MHz, 1 ~ 150W

$119.00
$136.85 inc. S.T.

DM800 Dip Meter

Frequency Range: 0.7 ~ 250 MHz (7 bands)
Power Supply: Battery (006P)
Compact Size: 75(W) x 155(H) x 45(D), 570g, coil case inclusive

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$113.85 inc. S.T.

PL830M Wide Band Dummy Load

Maximum Input Power: 40W
V.S.W.R.: Better than 1.1 (at DC ~ 300 MHz)
Heat Radiation: Natural Air Cooling

$ 70.00
$ 80.50 inc. S.T.

PL831M High Power Dummy Load

Maximum Input Power: 200W
V.S.W.R.: Better than 1.1 (at DC ~ 300 MHz)
Heat Radiation: Circulated Oil Cooling

$126.00
$144.90 inc. S.T.

B+K PRECISION

essional instruments from Trio and B&K.

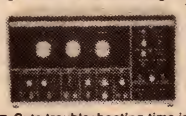
T.V. TEST GEAR

MODEL 467 CRT Restorer/Analyzer

- Exclusive multiplex technique tests all three guns of color CRT simultaneously under actual operating conditions
- Uses the most powerful restoration method known with minimal danger to CRT—guarantee results with confidence!
- All CRT's checked identically—including all "inline" and "one-gun" types
- The fastest way to test and restore any CRT
- EXCLUSIVE! Tests focus electrodes lead continuity
- Obsolescence proof: perpetual set-up chart updates and new adapter development

$337.00
$387.55 inc. S.T.

MODEL 1077B Television Analyst for PAL



PLUS THESE STABLE COLOR TV TEST PATTERNS: CROSSHATCH, DOT, COLOR BAR

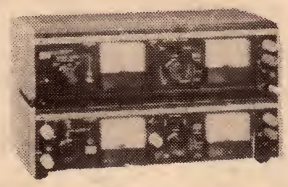
- Cuts troubleshooting time in half
- Drives solid-state sweeps
- Eight VHF channels
- All UHF channels 14-83
- 20-48MHz IF
- Audio, video, sync outputs

$655.00 **$753.25 inc. S.T.**

POWER SUPPLIES

Laboratory Power Supplies

MODEL **1601**



- Isolated 0-50VDC, continuously variable; 0-2A in four ranges
- Fully automatic shutdown, adjustable current limit
- Perfect for solid state servicing

$325.00
$373.75 inc. S.T.

MODEL **1602**

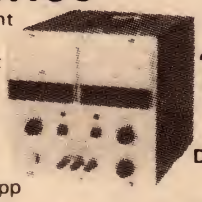
- 0-400VDC, 0-200mA, continuously variable,
- 0 to –100VDC, 0-100VDC, 0-2mA and 12.6/6.3 VAC at 3.5A
- Fully automatic shutdown, adjustable current limit

$325.00
$373.75 inc. S.T.

PR650 Series

- Constant voltage/current operation
- Fully adjustable output voltage
- Low ripple & noise

Line regulation: ±5mV
Load regulation: 2mV
Ripple: Less than 1.5mVpp



PR630 Dual Tracking Supply

Dual Output:
0 ~ +30V, 3A;
0 ~ –30V, 3A

Tracking: Negative Voltage Variable 20% Around Positive Voltage

Series Output: 0 ~ 60V, 3A

Model	V	A		
PR630	60	3.0	**$568.00**	**$653.20 inc. S.T.**
PR651	18	1.5	**$199.00**	**$228.85 inc. S.T.**
PR652	18	3.0	**$240.00**	**$276.00 inc. S.T.**
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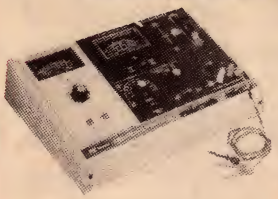
PR654	35	3.0	**$348.00**	**$400.20 inc. S.T.**
PR657	30	7.0	**$532.00**	**$611.80 inc. S.T.**

SEMICONDUCTOR TESTERS

MODEL 530 Lab-Quality Semiconductor Tester



- Measure f_T of bipolar transistors up to 1500 MHz
- Nondestructive testing of transistor and diode breakdown voltages
- Measures transistor beta or FET g_m
- Measures all transistor breakdown and leakage parameters
- Fast testing of transistors, FET's, and SCR's—in or out-of-circuit
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- No biasing information required
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MODEL 501A Semiconductor Curve Tracer

- Display characteristic curves for all semiconductor devices on your scope
- Measure breakdown voltage non-destructively
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- Complete with FP-5 probe

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$233.45 inc. S.T.

MODEL 510 Portable Transistor Tester

- Fast GO/NO-GO in-circuit transistor testing
- Fast and thorough GOOD/BAD out-of-circuit testing
- Tests FET's and SCR's in-circuit or out-of-circuit
- Connect any test clip to any component lead
- Gives positive emitter-base-collector identification in LO drive—positive base identification in HI drive
- Light-Emitting Diodes indicate NPN-OK or PNP-OK
- Pocket-size—Over 100 hours of testing from single set of "AA" cells
- Digital stability—no adjustments; nothing to go out of calibration
- Includes carrying case and leads

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MODEL 520B Industrial Transistor Tester

- Now with HI/LO Drive
- Works in-circuit when others won't
- Identifies all three transistor leads
- Random lead connection
- Audibly and visually
- indicates GOOD transistor
- Automatic NPN/PNP determination
- Positive Si/Ge identification
- Tests diodes, SCR's, FET's, and
- Darlingtons

$188.00
$216.20 inc. S.T.

PROBES

PC-15
Frequency range 100kHz to 300MHz (for VT-108)

$ 35.00
$ 40.25 inc. S.T.

PC-21
1:1 & 10:1 DC to 10MHz (for CS-1559 & CS-1562)

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PC-27
1:1 & 10:1 DC to 15MHz (for CS-1560A & CS-1560)

$ 40.00
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PC-28
1:1 & 10:1 DC to 30MHz (for CS-1570)

$ 45.00
$ 51.75 inc. S.T.

Model PR-21 Isolation Direct Probe For Models 277 280 281 282 283 290 1403. Prevents capacitive loading and RF interference when measuring DC in RF circuits. Has switchable 100K ohm isolating resistor. Terminated in molded double banana plug.

$ 14.75 **$ 16.96 inc. S.T.**

Model PR-25 10:1 and 1:1 Compensated Counter Probe. Reduce possibility of double counts when measuring square waves or digital steps with Model 1801. Direct impedance 1 meg shunted by 110 pF. 10:1 impedance 10 meg shunted by 10 pF. Frequency response 20 Hz to 60 MHz. BNC connector.

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Model PR-23 RF Detector Demodulator Probe. The B&K Model PR-23 is an all purpose detector demodulator probe usable with any electronic voltmeter (both analog and digital) or oscilloscope. Models 1403, 1431, 1440, 1460, 1465, 1470, and 1472. Typical Freq. Res. ±2 dB 15KHz to 125 MHz, within 6 dB to 250 MHz.

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Direct-Reading 40kVDC Probe

MODEL **HV-44**

$ 52.00
$ 59.80 inc. S.T.

MODEL FP-5 "Dyna-Flex" Probe

Model FP-5 "Dynaflex" Probe. Positive contact is assured by spring loaded needle-sharp tips. Spacing of 3 tips adjustable with one hand from 1.32 to 5.8 for rapid, easy access when testing densely packed miniaturized arrays. Eliminates costly time-consuming unsoldering operations. Each tip is colorcoded for fast, easy identification. Ideal for use with Model 510 Transistor Tester, Model 520 Dynapeak Transistor Tester or Model 530 Semiconductor Tester.

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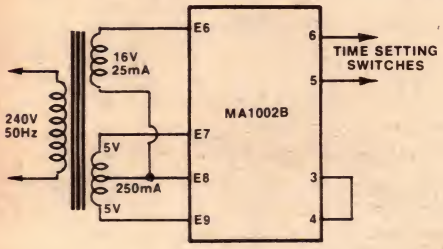
PM78

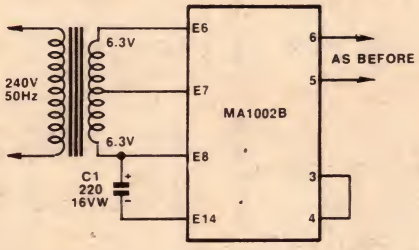
Circuit & Design Ideas

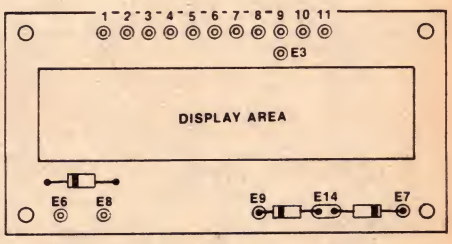
Conducted by Ian Pogson

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Your contributions are welcome, and will be paid for if used.

Substitute transformer for Modular Digital Clock







The MA1002 alarm clock module is generally powered by a special transformer, with one 10V CT 250mA winding and one 16V 25mA winding, as in the Modular Digital Clock described in "Electronics Australia" for December, 1976.

Perhaps it is not generally known that this module can be operated, with no sacrifice in performance, with a conventional 12.6V CT heater type transformer. The necessary connections to do this, together with the conventional circuit are shown. A diagram showing point E14, the junction of the two diodes is also given.

With this circuit, the supply rail for the display drivers is only half wave rectified but the addition of C1 brings the display brightness up to that obtained with the special transformer.

The transformer must be able to supply about 300mA and so the popular PF2851 type transformer is not really suitable, as it does not have a sufficiently high current rating. However, there are a number of other transformers available, such as the PL12/5VA, and many readers may even have a suitable transformer in the junk box.

(By Mr C. H. Mitchell, 18 Roderick Street, Wavell Heights, Qld 4012.)

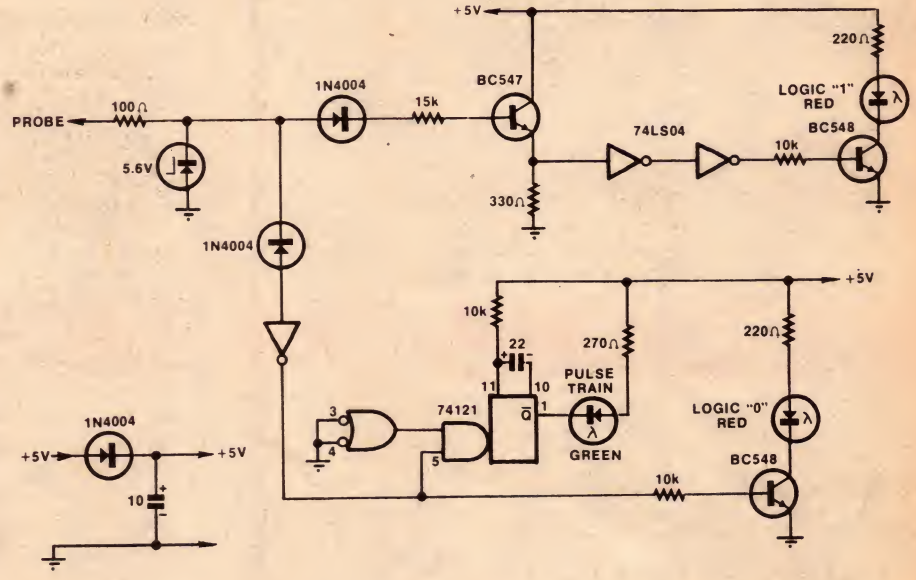
3-state logic probe

An oscilloscope is almost useless in logic work, especially with microprocessors where often single pulses of nanosecond duration need to be detected. In these circumstances, a good logic probe is essential. This probe is adapted from the 5-state design which appeared in "Electronics Australia" for December, 1974.

I eliminated the short circuit detectors because of the danger of shorting some logic families, e.g., PMOS, which are biased in such a way that they often approach the TTL rails. I added a pulse catcher and used LS TTL for detecting so as to reduce loading on the device being tested.

The whole circuit is on a PC board which fits into a transparent toothbrush container. The probe was made from a large safety pin. A darning needle could be used but it is rather more brittle than the safety pin. The point wire of the safety pin is cut off and soldered to the PC board, with a couple of turns of wire going through the board to hold the pin securely.

The LEDs are mounted in a line at the probe end. They are soldered close onto the PC board which then slides into the toothbrush case, the wire probe protruding through a hole in the end. Both "O" and "1" LEDs are red, so that the mark/space ratio can be judged. The pulse LED is green.



All LEDs "off" mean open circuit or tristate. All LEDs "on" mean pulse train with approximate mark-space ratio of 1;1. Green LED "on" and one red LED "on" mean pulse train with the logic spending most time in given state. Green LED flashes means pulse occurred.

(By Mr A. Peek, 10 Gale Street, Woolwich, NSW 2110.)

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For the beginner, or for the hobbyist as a reference book. Starts with the atom and ends with amateur radio and hi-fi systems. Includes simple circuits to build yourself.

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That's right! We have dozens more titles to choose from than those listed here – there wasn't the room!
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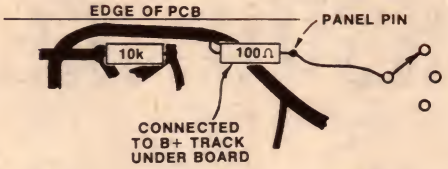
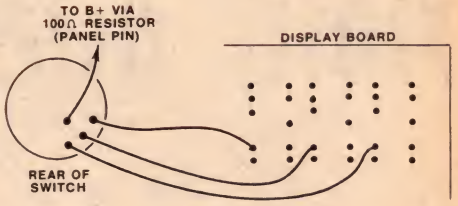
Decimal points for the 200MHz DFM

I recently built the 200MHz Digital Frequency Meter as described in March, 1977. Other readers may be interested in the extra facility which I have incorporated in my unit, which I think assists in interpreting the readings. This consists of illuminating one decimal point and switching it on the three ranges so that the decimal point indicates MHz on each range. This also indicates the range the switch is on without having to look at the switch.

All that is required is one 100 ohm resistor and some hookup wire. The vacant section on the range switch is used to switch the decimal point. The 100 ohm resistor is mounted on the back of the PCB and straddling the 5V supply rail as shown on the drawing. Three holes are drilled in the board. A panel pin is mounted in one hole and the leads of the 100 ohm resistor go through the other two and are soldered to the +5V supply track and the panel pin. The pin is used as the connection for the lead to the switch rotor.



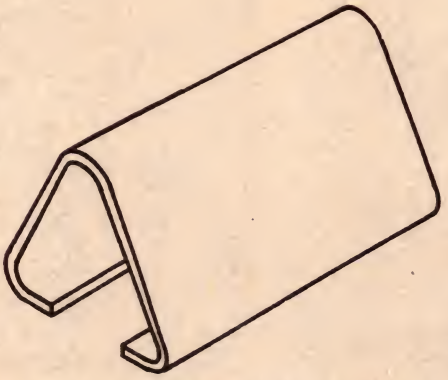


(By Mr P. Daw, "Woodlands", Wombat, NSW 2587.)

Heat sinks

So many electronic parts are easily destroyed by heat and must be soldered in place with heat sink clips. Most hobbyists run out of sinks because they do not solder each connection as it is made. If you make six, eight or a dozen connections before picking up the iron to solder them, you will soon exhaust your supply of commercial sinks. However, when this happens remember that you have many items on your workbench which you can use in their place.

Alligator and similar clips make good sinks, especially if the jaws are flattened. Slide-locking and self-closing tweezers are natural sinks. Needle-nose and other pliers can be used if you put a rubber band around the handles so that they will stay closed. Paper clips and metal hair clips can even be used as light heat sinks.



Finally, sinks for DIP ICs can be quickly made as shown in the drawing. Use sheet copper (or heavy aluminium) and make sure the contact edges are straight and smooth.

(From "Radio-Electronics".)

No cost clock for Baby 2650

Those readers using, or planning to use, the "Baby 2650" microcomputer described in the March 1977 issue with the Video Data Terminal in the January-February 1977 issues, may be interested in knowing that there is a way of avoiding adjustment of the microcomputer's clock oscillator to 1MHz. In fact if you are using the Baby 2650 with the video terminal, you can leave off the 74123 clock oscillator altogether!

This is because a 1MHz signal suitable for running the 2650 is already available on the EME-1 video display board, inside the video terminal. All you have to do to use it is run a wire from pin 12 of IC2, on the EME-1 PCB, to pin 3 of the 2650 microprocessor on the computer PCB.

That's all there is to it!

(By Peter Morrison)

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Calibrating a field intensity meter

The CSIRO National Measurement Laboratory is introducing a calibration service to cover the range from 20kHz to 300MHz for field intensity meters with loop or dipole antennas. The methods used to calibrate these meters depend on the frequency of operation and the type of antenna used, and are outlined in this article.

by DR J. HUNTER

A field intensity meter (FIM) is an instrument designed to measure the strength or intensity of an electromagnetic wave. It comprises an antenna, which intercepts the wave, and a meter, which measures the output from the antenna. A very simple FIM made from a piece of wire for an antenna, a diode and a DC millivoltmeter for a detector may be adequate for simple measurements such as the adjustment of an antenna to give maximum gain in a particular direction.

However, organizations such as those concerned with broadcasting and communications need to measure the absolute value of field intensity, so that the effectiveness of their transmissions can be checked. For example, a radio station designed to service a particular area may consider that listeners would not be attracted wherever the field intensity fell to less than 0.5mV/m. The boundary of the area effectively covered would be found by using a FIM to locate the 0.5mV/m contour surrounding the station.

Many computers must be protected from field intensities greater than 1V/m to avoid error-causing RF voltages being induced in their circuits. A FIM giving an absolute measure of field intensity is needed to check the site of the proposed installation and the effectiveness of any protective screening which may be necessary.

For an absolute measure of field intensity a FIM must be calibrated against a known field level. Since some FIMs are designed to measure at frequencies as low as a few kilohertz and others as high as several gigahertz, no one method of calibration can be expected to be the best for all instruments.

The most common commercial FIMs operate somewhere within the frequency range from the broadcast band at a few hundred kilohertz to the VHF range at several hundred megahertz, and have the main elements shown in Fig 1. Usually other elements are included, such as IF and DC attenuators, several mixing stages, a choice of bandwidth, frequency scan capability, an audio amplifier to allow monitoring of the received signal, and a choice of detector functions to display peak, quasi-peak, or RMS levels.

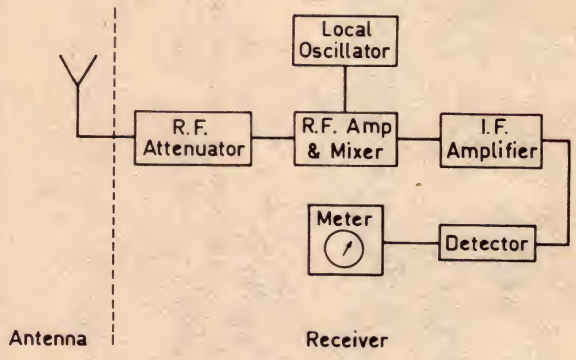


FIG.1 FIELD INTENSITY METER

These instruments can be regarded as the combination of an antenna and a frequency selective voltmeter.

The response of the antenna to an electromagnetic wave is described by the "Antenna Factor" (AF), which is the ratio of incident field intensity to output voltage at a particular frequency. The higher the AF, the less responsive is the antenna to a given field. Typical antenna factors for a single turn loop antenna of 40cm diameter range from 64dB at 20kHz to 34dB at 20MHz, while a matched dipole may have an AF of around 12dB at 200MHz.

The voltmeter or receiver section of a typical FIM would have a sensitivity of around 0.1 microvolts (uV) depending on the signal frequency and bandwidth. When in use, the reading of the FIM in decibels relative to a microvolt dB (uV) is added to the AF to give the measured field intensity. A FIM reading of 40dB (uV) or 100uV obtained with an antenna with an AF of 20dB signifies a field intensity of 60dB relative to a microvolt per metre, or 1mV/m.

The direct calibration of a FIM at one frequency would require the provision of known fields at many intensity levels so that a sufficient number of attenuator settings and meter readings were calibrated for the instrument to be useful. A simpler alternative is to calibrate the FIM in two stages — firstly, calibrate the receiver as a voltmeter, usually in terms of microvolts or decibels relative to a microvolt; and secondly, calibrate the FIM in a field at one known intensity level.

The calibration as a voltmeter requires three steps. First a known voltage, usually 1-10mV, at the required frequency is applied to the receiver, and the meter reading is noted. Secondly, the linearity of the receiver is measured by varying the applied voltage. Finally the receiver attenuators

are calibrated by comparing the effect of their introduction with that of a standard attenuator.

At frequencies below about 30MHz it is common to use loop antennas for field intensity measurements. These antennas respond to the average normal component of magnetic field intensity and consequently a known standard of magnetic field intensity is required for their calibration.

NML uses a single turn electrically balanced wire loop of 20cm diameter as a transmitting antenna to create a magnetic field intensity of approximately 0.3A/m. The current of 100mA at the top of the loop is monitored, and the magnetic field intensity calculated from the geometry. Account must be taken of the current variation around the loop, particularly when the circumference is an appreciable fraction of a wavelength.

The standard transmitting loop is placed coaxially with the loop antenna of the FIM at a distance between 0.75m and 1.5m, where the useful component of magentic field intensity decays approximately as the reciprocal of the cube of distance. Because of this, reflection of electromagnetic energy from surrounding objects is not a major problem. Present NML calibration uncertainties for FIMs using loop antennas are 0.3dB for 1MHz to 5MHz, and 0.5dB for 5MHz to 30MHz.

The standard of magnetic field intensity can be checked against another electrically balanced wire loop with a diode detector inserted. The diode is previously calibrated so that the DC output voltage for a given applied RF voltage is known. After allowing for any partial resonance the RF voltage induced in the loop can be deduced from the DC output, and hence the average normal magnetic field intensity calculated.

It must be remembered that a FIM with a balanced or electrostatically shielded loop antenna responds to the magnetic field intensity. For FIMs which are scaled to read in terms of electric field intensity the implied conversion is valid only if the field is the equivalent of a free space plane wave. In any other situation, the electric field intensity indicated when a loop antenna is used is inaccurate — the only accurate measure is the magnetic field intensity.

For field intensity measurements at frequencies from about 30MHz to several hundred MHz, dipole or biconical antennas are commonly used. These antennas respond to the electric field intensity of an electromagnetic wave, and therefore require a known electric field at the appropriate frequency for calibration.

To calibrate these FIMs, a horizontally polarized field of approximately 100mV/m (electric vector horizontal) is transmitted, and received at a distance of several wavelengths by a resonant dipole with a calibrated detector. The detector is a miniature glass-encapsulated silicon point contact diode chosen for its low shunt capacitance.

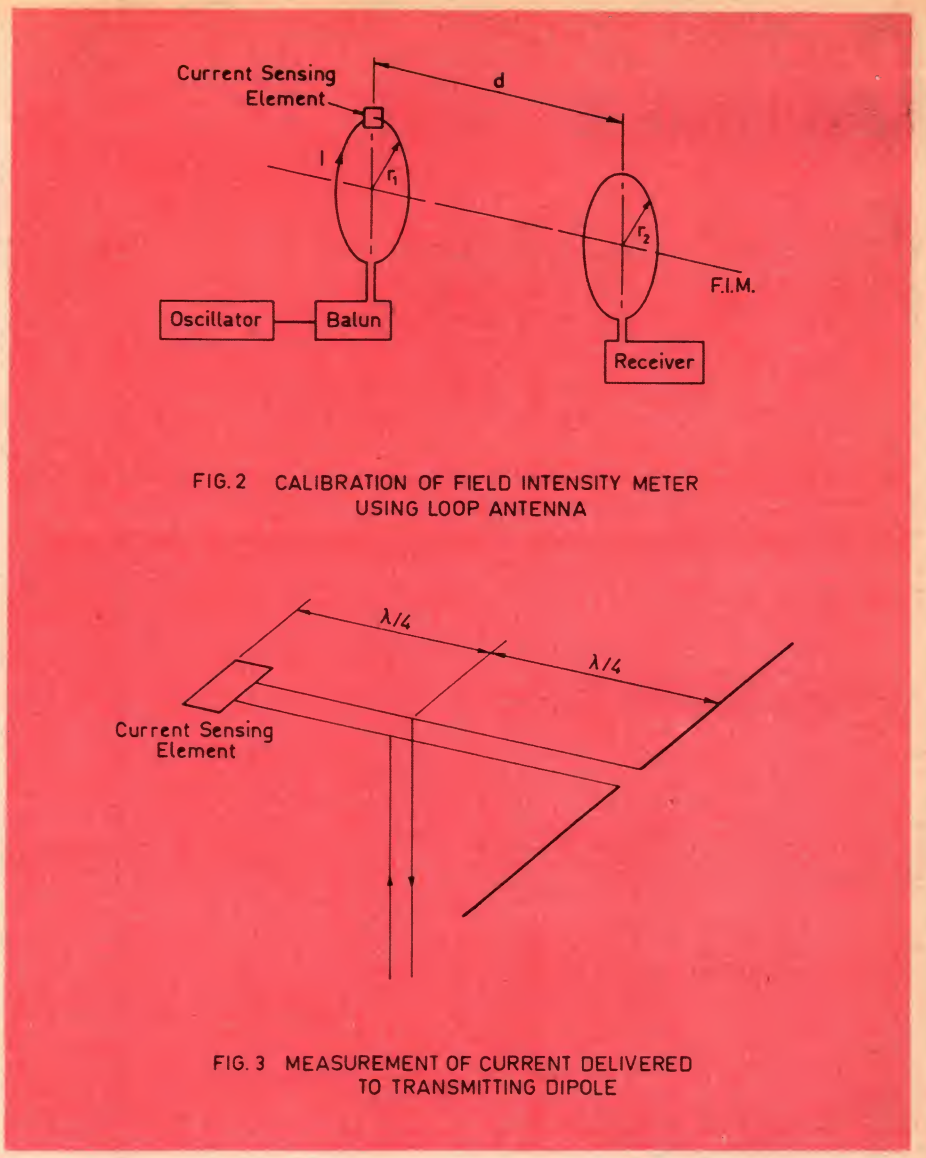


FIG. 2 CALIBRATION OF FIELD INTENSITY METER USING LOOP ANTENNA

FIG. 3 MEASUREMENT OF CURRENT DELIVERED TO TRANSMITTING DIPOLE

The RF voltage induced in the dipole is calculated from the DC output of the diode and its calibration. This, combined with the known characteristics of the dipole, enables the field intensity at the location to be standardized. The antenna of the FIM is then substituted at the same location and the FIM calibration completed.

Because this calibration procedure is sensitive to reflections from nearby objects, NML uses a large, flat, open area some 40km south-west of Sydney as a calibration site.

The standard field can be checked by using another dipole of known characteristics as a transmitter, and calculating the field created. The current fed to the transmitting dipole is measured by making use of the property of a quarter wave lossless transmission line that the load current is independent of the load impedance. Thus when two quarter-wave lossless lines are fed with a common voltage, as in Fig 3, the current at the dipole terminals has the same value as that in the current sensing element.

In order to calculate the ground reflection from the transmitting dipole the electrical characteristics of the ground (conductivity and permittivity) must be known. These parameters are determined by mounting a horizontal receiving dipole below another horizontal dipole transmitting at a frequency of 100MHz.

A standing wave is created below the transmitting dipole by the addition of the direct and ground-reflected fields, and is detected by moving the receiving dipole up and down. The ground characteristics are calculated from the magnitude and location of the standing wave pattern.

For further information, contact Dr J. Hunter, at the CSIRO National Measurement Laboratory, University Grounds, City Rd, Chippendale 2008.

A direct reading inductance meter

This low-cost inductance meter should appeal to many electronics enthusiasts. The unit is easy to build, uses readily available parts, and features direct readout of inductance on three ranges from 4*u*H-10H. Why not build it as a companion instrument to the Direct Reading Capacitance Meter?

by B. M. BYRNE*

The need for this device follows on fairly logically from construction of the Direct Reading Capacitance Meter (EA October 1976 and July 1977). Although an inductance meter is not as frequently needed as a capacitance meter, there are those odd occasions where a circuit calls for a particular inductance, and the chances of guessing which of a dozen or so coils on hand will suit are remote.

Unlike capacitors, also, coils are infrequently marked as to value.

At first, it seemed quite feasible to construct an impedance measuring device, not unlike the capacitance set, but with an "ohms" type of scale. Some amount of bench work proved that this idea was just not on. The very wide range of Q ($2\pi Lf/R$) between each individual coil and the next just killed the idea, as errors were found commonly to exceed 30 per cent of the true value.

This left the prospects as:

(1) To make an AC Bridge — not impossible, but a fairly formidable task to achieve an acceptable grade of instrument.

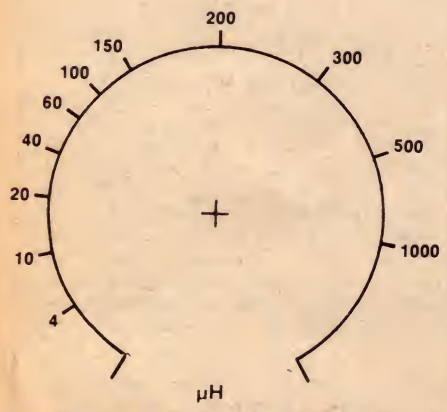
(2) To use a resonance detector. This system seemed more attractive and was in fact successful.

The principle is to produce a variable frequency AC signal of adequate power — some two or three volts at relatively low impedance (50 ohms or so in this case).

Next, the unknown inductance "L" is fed with this signal, with a known high Q capacitor "C" connected across it. As the frequency is swept across a suitable range, the impedance of the LC circuit rises markedly at resonance. A simple detector registers the condition. The actual sweep of the oscillator control can thus be calibrated direct as inductance, as "C" is constant and known.

There are quite a few options on how to achieve the foregoing, and just how elaborate the system can be made. As the aim of the design included simplicity, but with the ability to cover from about 5*u*H to 10H, a few compromises had to be made. Principally, these surface as limited sensitivity on low Q coils (generally high inductance, iron cored units). However, the absolute value of these is usually not of any great significance, and the compromises made are perfectly acceptable.

The circuit employs a total of seven transistors, together with associated components. The first three transistors are arranged in a traditional Wien bridge configuration. Such oscillators are reliable and relatively trouble free.



Approximate dial scale calibrations. A more accurate scale can be made up by calibrating against known inductors.

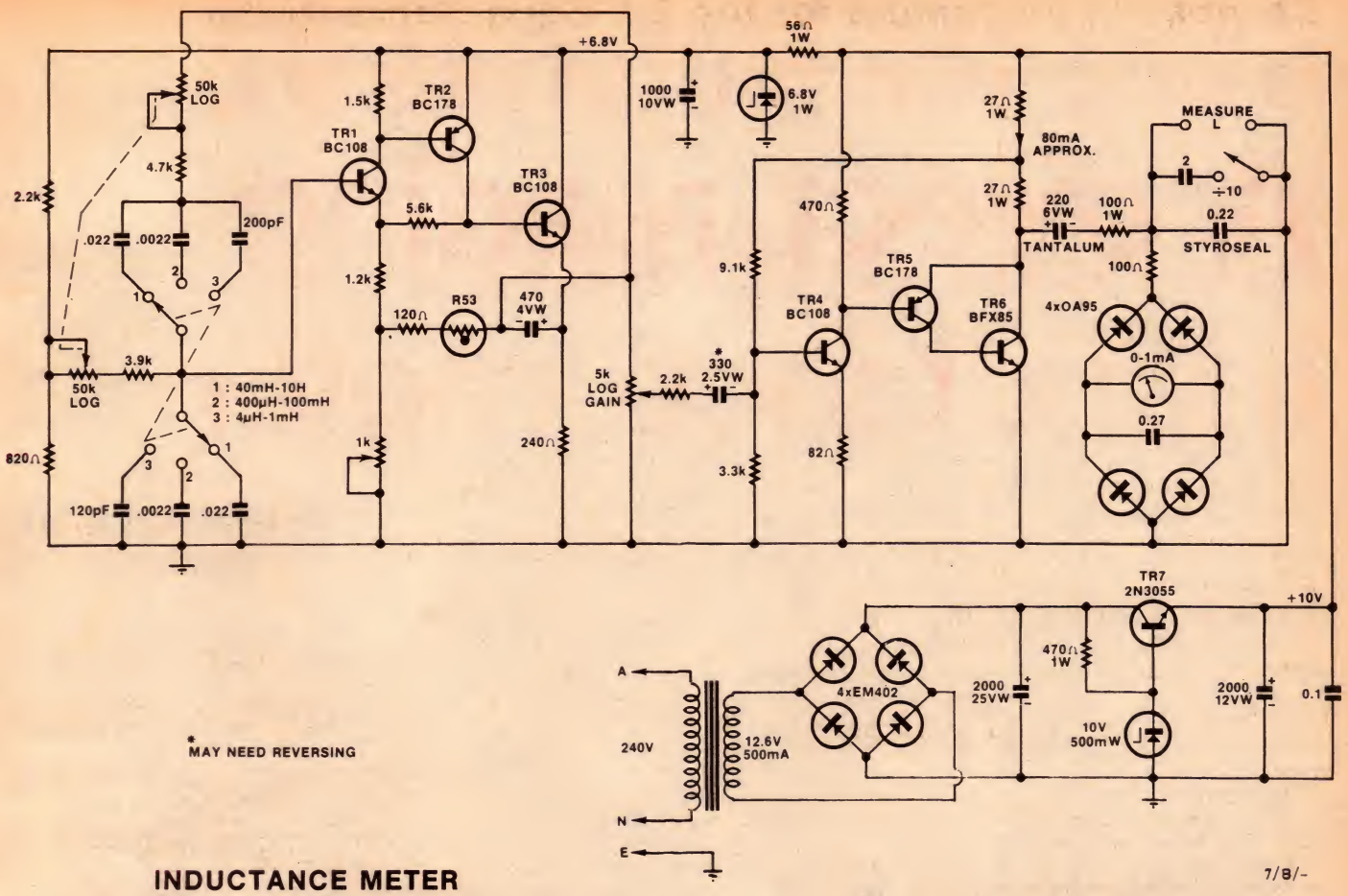
A folded aluminium case houses the instrument constructed by the author.

The only component that might present a supply problem is the A53 thermistor. This component, however, is essential as it provides a simple and effective means of negative feedback control to keep the oscillator running with constant amplitude and low distortion.

A 1k preset pot. is initially used to adjust the amount of feedback. It will normally be set about halfway, so that the oscillator just runs on all scales. An oscilloscope is a useful aid when setting up, but is not essential.

Almost any general purpose silicon transistors can be employed in the oscillator circuit. TR1 and TR3 are NPN transistors, while TR2 is a PNP device.

The oscillator output is fed through a 5k gain control pot. to a direct coupled 3 transistor amplifier. TR4 is a general purpose NPN device, TR5 a PNP. The output transistor should be capable of dissipating about a watt, and a larger BFX85 is specified. This transistor should be fitted with a small clip-on



INDUCTANCE METER

heatsink to ensure adequate cooling.

The output is taken via a low loss tantalum capacitor and a 100 ohm resistor to the test terminals. A 0.22*u*F high Q (polystyrene) capacitor is wired permanently across these terminals, while a 2*u*F unit is switched in parallel to provide a "divide by 10" range.

The 100 ohm resistor in series with the output is a compromise value chosen to isolate the resonant circuit from the amplifier. Its value favours the measurement of high Q, low L inductors.

The range switch of the unit provides three oscillator sweep ranges, which give x1, x10 and x100 frequencies. These correspond to x1, x100 and x10k inductance multipliers. If measurements up to 1000*u*H are sufficient, then the range switch could be omitted.

The main control is the 50k (curve C) frequency sweep potentiometer. This pot. determines the calibration of the instrument. Consequently, while an approximate scale is reproduced with this article, it is far better to obtain a few known inductors and calibrate a new scale.

Alternatively, an oscilloscope could be used to determine the frequency at suitable scale points. These, together with some calculations for the 0.22*u*F capacitor at resonance will then indicate the appropriate scale calibrations.

The power supply is simple. A 12V 0.5A transformer drives a bridge rectifier and a 2000*u*F 25VW electrolytic to produce about 17V. A 2N3055 regulator transistor and an associated 10V zener diode then derives the 10V (approx.) supply rail for the amplifier. A further resistor/zener network derives a supply of around 6.8V for the oscillator.

The output detector is a 1mA meter with four germanium diodes (preferable because of their lower voltage drop) in bridge configuration, plus a 100 ohm protective resistor. Its sole function is to indicate a maximum value at resonance as the 50k pot. sweep is ranged across its travel.

As both the oscillator and amplifier have a few output/frequency humps, it is advisable to remove the inductor from the test terminals to ensure that the meter is indicating a true peak at resonance and not just an output hump. There will be no doubt at all on the lower inductance/high frequency ranges, but the low Q of larger inductors will make this check essential on the lowest frequency range.

Construction of the unit is straightforward, as component layout is not critical. Suffice to say that the prototype was built up on Veroboard and fitted to an aluminium case, as shown in the photograph.

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Using the Motorola D2 kit with a terminal

Computer hobbyists and schools who have the Motorola MEK6800D2 evaluation kit should find this article interesting. It explains how the kit may be converted easily and with minimum outlay to interface with a video terminal or teleprinter, using standard 20mA current loops. It also gives details of useful subroutines available in the terminal-orientated MINIBUG-III ROM.

by JAMIESON ROWE

Since we wrote about the Motorola MEK6800D2 "Mark 2" evaluation kit in the May 1977 issue, quite a few of the kits have apparently been sold. It would seem that many people agreed with our basic finding, that the kit provided an attractive way of building up a 6800-based system suitable for learning 6800 programming and working on program development.

Probably one of the features that appealed to people was the kit's expandability. For example although it comes with only 256 bytes of user-available RAM, the PCB provides decoding and sockets for the addition of a further 256 bytes merely by plugging in a further pair of MCM6810 RAM chips. There are also two further sockets, which may be arranged quite easily to accept either a pair of 1024-byte EPROMs (2708 or similar), or a pair of 2048-byte mask-programmed ROMs (MCM68316 or similar).

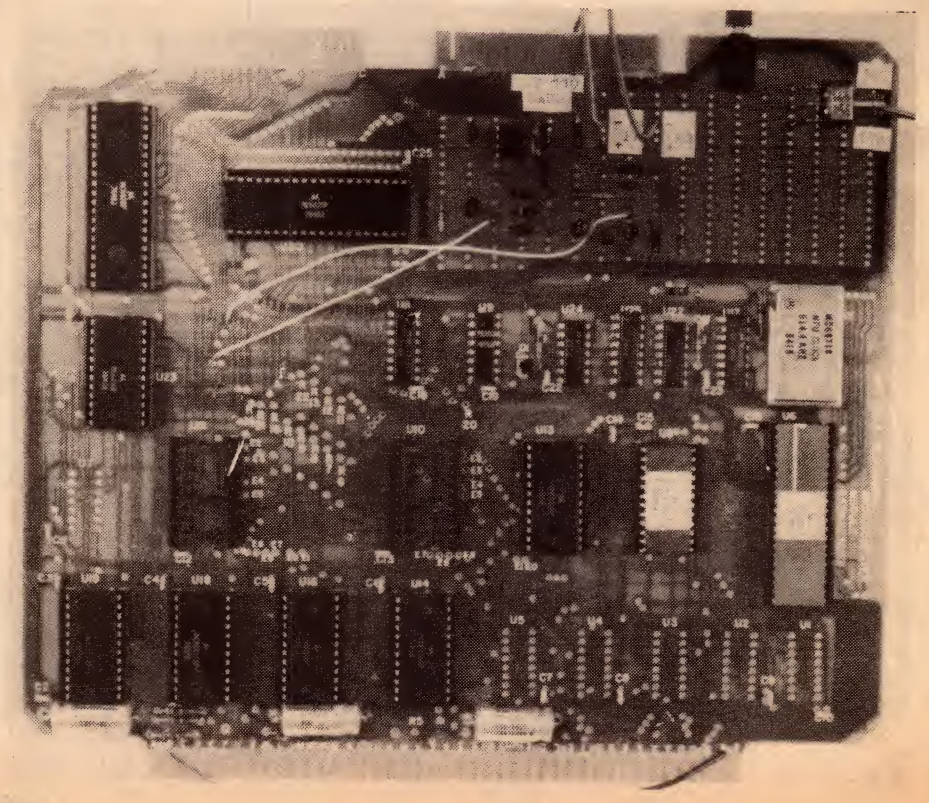
To allow for still further expansion the PCB is provided with spaces for the addition of data and address bus buffers, so that external memory boards and further peripheral interfaces may be connected. As the kit already offers two MC6820 PIA (peripheral interface adapter) devices, each providing two 8-bit bidirectional peripheral interface ports, and an MC6850 ACIA (asynchronous communications interface adapter) which provides a serial input and output, this makes it very suitable for expansion into a full-scale minicomputer or development system.

Motorola itself makes available a number of compatible memory boards, including two dynamic RAM boards offering either 4096 bytes or 16,384 bytes of memory (MM68100, MMS68104). However these are probably a little elaborate for most hobbyists, being more suitable for the professional user. A more attractive approach for the hobbyist would probably be to use one of the low cost memory modules now available using static RAM chips.

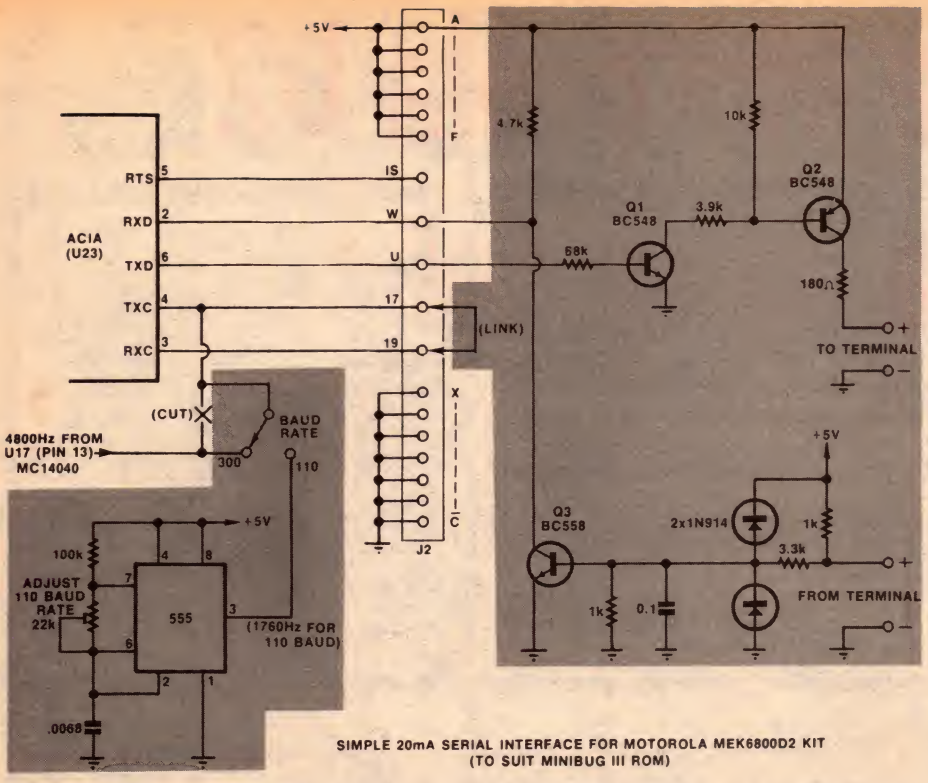
Apart from memory expansion, perhaps the most likely thing that both hobbyist and professional D2 kit users will want to do to their system is modify it for use with a video terminal or teleprinter. Although the original 24-key keyboard and LED-display "terminal" supplied with the kit is quite sufficient for one's initial foray into 6800 system operation and development of simple programs, it is not really suitable for serious work. Programs may be stored on cassette tape, but cannot be entered efficiently in the first place or listed conveniently for examination. Word processing and games are not really feasible with the simple terminal, either.

Anticipating that many users would want to modify their D2 kit for use with a standard terminal, Motorola has made available a suitable terminal-orientated debug/monitor program. The debug/monitor is called "MINIBUG-III", and it comes in a mask-programmed ROM which is pin-compatible with the original JBUG monitor ROM supplied as part of the D2 kit.

The firm has also made available an application note (AN-771), giving details of the ways that the D2 kit may be expanded, and including informa-



Pictured at right is our D2 kit, modified for 110/300 baud terminal operation as described in this article.



SIMPLE 20mA SERIAL INTERFACE FOR MOTOROLA MEK6800D2 KIT
(TO SUIT MINIBUG III ROM)

Details of the circuit modifications required for using the D2 kit with a 20mA video terminal or teleprinter. The 555 provides the 110-baud clock.

tion on modification of the kit for use with a terminal. The application note is available on request to professional users, but not to hobbyists. In any case it is intended primarily for the professional, dealing mainly with fairly elaborate expansion techniques and in many places providing only very cursory explanations.

The details given for interfacing to a terminal assume that the user will want to implement a dual-monitor system, wherein both the JBUG and MI IBUG-III monitor ROMs are in circuit and alternatively selectable by means of either a hardware switch or software instructions. It seems unlikely that many hobbyists will want to go that far. Also shown is the use of opto-couplers for full electrical isolation of the terminal interfacing; as most hobbyists will be using video terminals with opto-couplers already fitted, this is really not necessary.

Actually if you simply want to implement a basic system, using just the MINIBUG-III ROM and low-cost interfacing to a standard 110-baud or 300-baud terminal, the application note isn't very helpful. You're apparently expected to work out the details for yourself.

Having gone through this exercise myself the hard way, I thought readers might like to benefit from my experience. It turns out that apart from the replacement ROM with MINIBUG-III, all you need are three low-cost transistors, a 555 timer IC and a few minor components.

The modifications and circuit additions are shown in the circuit. For convenience they can be split into two distinct sections: that associated with actual interfacing to the terminal, and that concerned with setting the communications baud rate.

The MINIBUG-III monitor program is designed to communicate with the terminal via the MC6850 ACIA device, labelled "U23" on the D2 kit PCB. The ACIA is similar to a UART, except that is bus orientated: the data format and clock divider rate are software programmable, while the transmitter and receiver status are available for software interrogation.

Data from the computer emerges in asynchronous serial form from the transmitter section of the ACIA at the "transmit data" (TXD) output, pin 6. This also connects to the J2 output connector of the kit PCB, at pad U. The data at this point is in TTL voltage-level form: logic high level corresponds to "mark", and logic low level to "space".

In order to drive a standard video terminal or teleprinter this voltage-level signal must be converted into the equivalent 20mA current-loop signal, with "mark" corresponding to 20mA DC current flow and "space" to zero current. This is done by the additional circuitry using transistors Q1 and Q2.

Transistor Q1 is driven from the TXD output of the ACIA, so that when the TXD output is at the high logic level for "mark", Q1 is driven into saturation. This causes transistor Q2 to be driven into conduction also, passing current to the display/printer section of the terminal. The 180-ohm resistor sets the current level to the nominal 20mA figure required.

When the TXD output of the ACIA falls to the logic low level for "space", transistor Q1 cuts off. This causes Q2 to cut off also, interrupting the loop current. Hence Q1 and Q2 provide a simple TTL voltage level to 20mA current loop interface.

The serial input of the receiver section of the ACIA is its "receiver data input" (RXD), pin 2. This also connects to pad W on PCB connector J2, in the D2 kit. Like the transmitter output, the RXD input is designed to accept TTL voltage logic levels, with logic high corresponding to "mark" and logic low to "space".

As the keyboard output of a video terminal or teleprinter is basically a set of switch contacts (either mechanical or solid state) which are closed for "mark" and open for "space", a conversion circuit is again needed in order to produce the TTL levels required by the ACIA. This conversion is performed by the additional circuitry shown around transistor Q3.

Essentially the circuit consists of an inverter stage using Q3, with its base potentially forward biased via the 3.3k and two 1k resistors. However the keyboard switch is connected so that when closed for "mark", it shorts out the forward bias and causes Q3 to be cut off. The 4.7k collector resistor of Q3 thus pulls the RXD input of the ACIA to the corresponding logic high level.

When the keyboard switch opens for "space", however, the forward bias is applied to Q3 and the transistor is driven into saturation. This pulls the RXD input of the ACIA down to the corresponding logic low level.

The 0.1uF capacitor is used in conjunction with the 3.3k resistor as a filter to suppress any contact bounce that may occur with teleprinter keyboards. The filtering is not strictly necessary with video terminals having a solid state switch or opto-coupler on the keyboard output, although I suggest you leave it in because it filters any hum which may be induced into the cable.

The two diodes are to protect the transistor from any "spikes" which may be generated in the cable due to induction or the effects of cable inductance. Again they are not strictly necessary if you are using a cable only a few feet long — particularly if it is shielded — but I suggest you leave them in as they only cost a few cents.

The circuitry associated with Q1, Q2 and Q3 thus performs the actual terminal interfacing. The remaining part of the circuitry added to the D2 kit is used to provide the ACIA with the appropriate clock signals, so that it can operate on the data rates of 110 or 300 baud expected by the MINIBUG-III monitor program and most video terminals and teleprinters.

In the D2 kit as originally wired ac-

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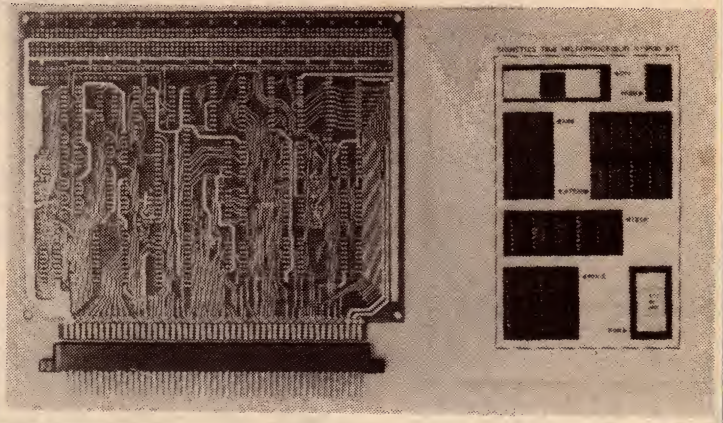

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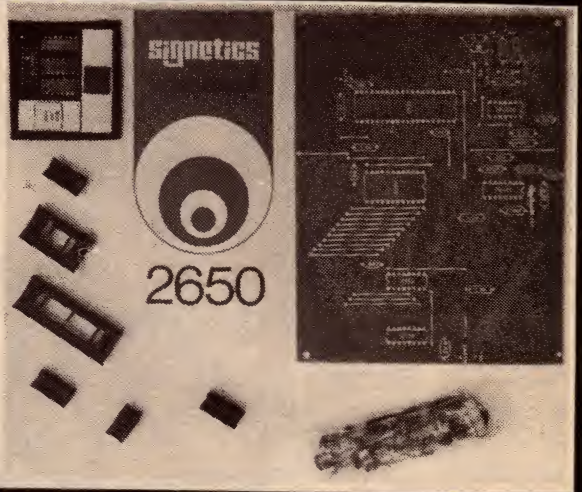

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cording to the Motorola manual, the ACIA is used with an audio FSK (frequency shift keying) interface on the matching "terminal" PCB, for dumping on and loading programs from cassette tapes. The data rate used is 300 baud, and the corresponding 4800Hz clock signal required by the ACIA transmitter (16 times 300) is derived from U17. This is an MC14040 multi-stage binary divider IC, driven in turn by a 1.2288MHz signal from the MC6871 crystal clock generator (U15).

As originally wired the 4800Hz signal connects to ACIA pin 4, the transmitter clock input (TXC). The receiver clock input RXC (pin 3) is fed with a recovered 4800Hz clock signal, derived by the FSK interface from the tape recording itself.

To use the ACIA with a standard video terminal or teleprinter, it is necessary to connect the TXC and RXC inputs of the ACIA together so that they operate at the same clock rate. This is most easily done by joining the two together with a wire link near the J2 edge connector. The two clock inputs run to connector pads 17 and 19, and they can be joined easily near the pads.

As the TXC input is still at this stage connected to U17 via the PCB pattern, the link between the TXC and RXC inputs of the ACIA will enable the system to communicate with a terminal at a fixed, crystal-locked 300 baud rate.

The MINIBUG-III monitor ROM can communicate at this rate, as can many video terminals and some teleprinters. However with MINIBUG-III it is actually necessary to use 110-baud communication at least upon initial switch-on, in order to tell the monitor to change to 300-baud operation. For this reason and to allow the system to work with 110-baud terminals, it is necessary to modify the clock feed circuit.

The photographs below should give you a good idea how we added the additional circuitry to the PCB of our D2 kit.

The first step is to cut the existing PCB track from U17 to pin 4 of the ACIA (U23), to allow a choice of baud rates. Do this by carefully cutting the PCB track on the underside of the board, at a point about 30mm from the ACIA. This is just beyond a small plated-through hole which carries the track from pin 4 to the top of the board and hence to the J2 connector. The cut therefore severs only the underside track leading to U17, and leaves the track to J2 intact.

Having done this the next step is to provide a source of ACIA clock pulses for 110-baud operation. As there is no suitable source of pulses in the existing D2 kit circuit, it is necessary to add a simple pulse generator using a 555 timer. This is shown in the circuit, and as you can see it involves very few components apart from the IC itself. The 22k trimpot allows the 555 output frequency to be set to 1760Hz, the correct frequency for the ACIA to operate at 110 baud.

The remaining thing is to add a small switch, to allow the ACIA to be fed with either the 4800Hz or 1760Hz, corresponding to 300 or 110 bauds respectively. The 4800Hz signal fed to the switch is taken from pin 13 of U17, as before.

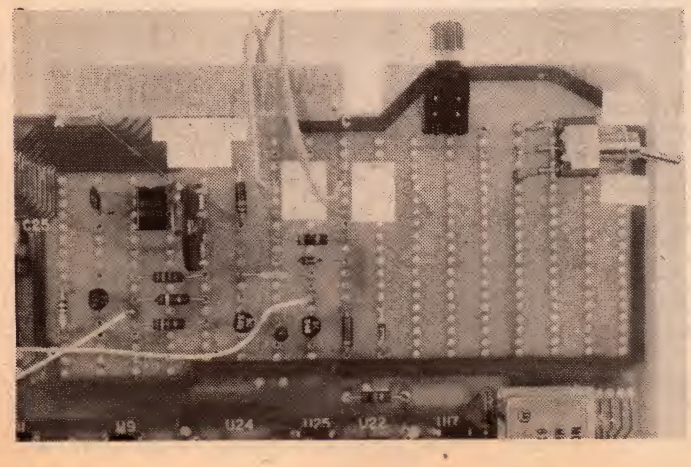
Incidentally, it should be noted that U17 actually provides a number of other crystal-derived signals, capable of being used to run the ACIA at other baud rates. Although the MINIBUG-III monitor program is only designed to communicate at 110 or 300 baud, you may well want to use higher rates once you have written a few programs of your own — assuming your terminal is capable of running at higher rates also.

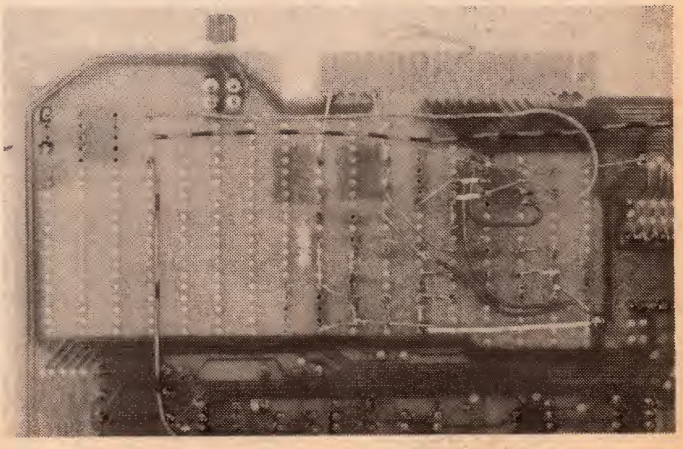
TABLE 1 : MINIBUG-III FUNCTIONS

MONITOR FUNCTION	MINIBUG III COMMAND	NOTES
Display Internal Registers	R	1
Load RAM from Tape	L	
Dump RAM to Tape (Punch)	P	2
Memory Examine/Change	M	3
Go to Entered Address and Execute	G	4
Set Terminal Baud Rate	S	5
Trace One Instruction	N	
Set a Breakpoint	V	6
Reset a Breakpoint	U	
Continue Execute from Breakpoint	C	
Delete All Breakpoints	D	6
Print Addresses of All Breakpoints	B	
Trace N Instructions	T	

NOTES

1. Order of Display: (PC,SP,CC,B,A,X).
2. Before executing, load beginning and ending address of range in locations A002 to A005.
3. Enter M followed by address. Contents are displayed after typing last address character.
4. Type G, followed by address. Execution begins after type of last character.
5. For 110 Baud: Type S1. For 300 Baud: Type S3.
6. Type address where breakpoint is desired, followed by V. A total of 8 may be entered. Removal of all breakpoints executed by typing V not preceded by address.
7. IRQ vector must be stored at A000/A001, NMI must be stored at A006/A007.





Using the Motorola D2 kit with a terminal . . .

The full list of frequencies available from U17 is listed below, together with the corresponding baud rates:

Pin No.	Frequency	Baud Rate
14	1200	75
12	2400	150
13	4800	300
4	9600	600
2	19200	1200
3	38400	2400
5	76800	4800
6	153600	9600

You may care to fit a multi-position switch in place of the two-position switch shown in the circuit, to allow further baud rates to be selected. However note that the keyboard input filter circuitry connected to Q3 will have to be modified for very high baud rates.

As you can see from the photographs, I wired the additional circuitry in the area on the D2 kit PCB provided for additions. The wiring is not critical, and there is plenty of room. The 110/300 baud rate switch is mounted at the side of the board, near the reset button. It is held in place by the three connection wires, soldered to both the board holes and the switch lugs, and also by a small loop of tinned copper wire pulled tight around the threaded ferrule and soldered to the board.

The terminal connections are made available at four PCB pins, two for the display/printer and two for the keyboard. On the hardware side, that is all there is to it.

As far as software is concerned, the monitor and debug functions performed by MINIBUG-III are shown in Table 1 together with some brief notes on their operation. As you can see, MINIBUG-III allows programs to be loaded, examined, dumped and executed with breakpoints for debugging. This allows programs to be developed very quickly and conveniently.

Apart from using MINIBUG-III in this way, it contains a number of useful subroutines which may be called by your own programs. There are 13 such subroutines, according to the Motorola literature, all of them concerned with input and output of information via the terminal. Table 2 lists them for your information, together with their address in the ROM and details of their entry and exit requirements in terms of register contents, etc.

At the time of writing, no listing of MINIBUG-III is available from Motorola, so this information is all that is available. However if you are really interested in finding out more, you could try writing a disassembler program and turning it loose on the ROM, for a start.

TABLE 2 : Accessible subroutines in MINIBUG-III

(Hexadecimal starting address of each is shown in brackets)

BADDR (E0F8) — Built a 16-bit hexadecimal address from four digits entered from the keyboard.
Entry requirements: none.
Exit: X-register contains the 16-bit address. A & B registers destroyed.

BYTE (E106) — Input two hex characters from the keyboard and form a 1-byte number.
Entry requirements: none.
Exit: A-register contains the 8-bit number. B-register is destroyed.

OUTHL (E118) — Output left digit of hex number to console.
Entry requirements: A-register contains hex number.
Exit: A-register is destroyed.

OUTHR (E11C) — Output right digit of hex number to console.
Entry requirements: A-register contains hex number.
Exit: A-register is destroyed.

OUTCH (E126) — Output one ASCII character to terminal.
Entry requirements: A-register contains ASCII character output.
Exit: No change.

INCHP (E133) — Input one character, with parity, from terminal to A-register.
Entry requirements: None.
Exit: A-register contains character input.

OUTS (E19A) — Output a space.
Entry requirements: none.
Exit: A-register destroyed.

PDATA1 (E14B) — Print at terminal the ASCII data string pointed to by X-register. Data string must contain an ASCII EOT (04) as a terminator.
Entry requirements: X-register contains the address of the 1st byte of the data string. The data string is terminated with a 04 character.
Exit: A-register is destroyed. X-register contains address of 04 character.

OUT2H (E18D) — Output two hex characters, pointed to by X-register contains the address of the characters to be output.
Exit: A-register is destroyed. X-register is incremented.

OUT2HA (E10F) — Output two hex character in A-register to the terminal.
Entry requirements: A-register contains the characters to output.
Exit: A-register is destroyed. X-register is incremented.

OUT4HS (E196) — Output four hex characters (2 bytes) plus a space to the terminal.
Entry requirements: X-register contains address of first byte.
Exit: A-register is destroyed. X-register contains address of second byte.

OUT2HS (E198) — Output two hex characters (1 byte) and a space to the terminal.
Entry requirements: X-register contains address of byte to output.
Exit: A-register is destroyed. X-register is incremented.

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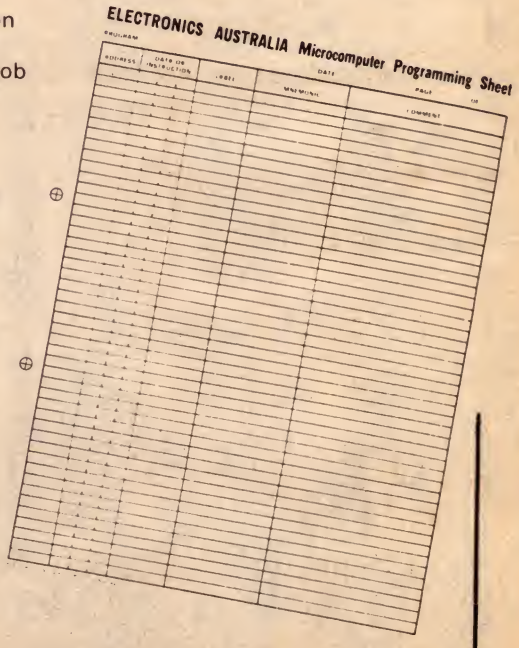

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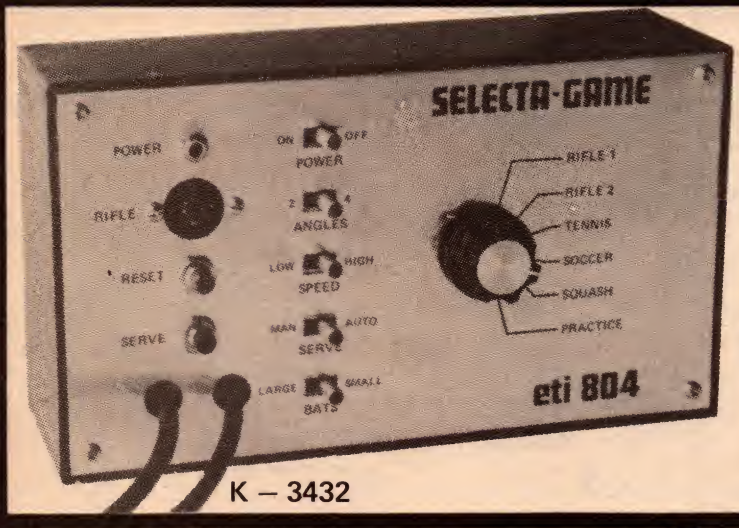

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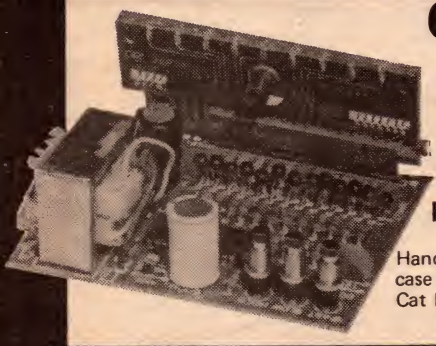

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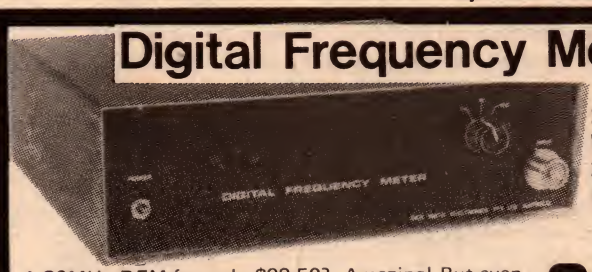

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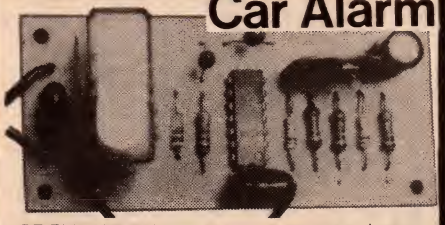

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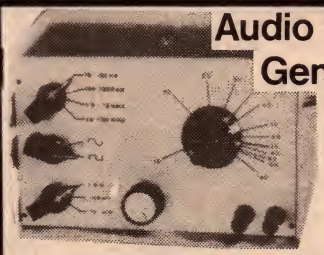

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Fast 8-bit bipolar microprocessor

SIGNETICS 8X300

Signetics has recently released an evaluation kit for its new 8X300 bipolar microprocessor. In this article we give a brief summary of the 8X300 chip itself, and of the evaluation kit.

by DAVID EDWARDS

The 8X300 has been designed to be a fast microprocessor controller, and because of this differs considerably from conventional NMOS microprocessors that we have considered in the past. Perhaps the major difference is that it is implemented with bipolar Schottky technology, and can fetch, decode and execute an instruction in only 250 ns.

The device is supplied in a 50-pin DIL ceramic package, and runs from a single 5V supply rail. An external pass transistor is required to complete an on-chip voltage regulator, which supplies 3V to selected areas of the chip. This helps to maintain the total current drain of the chip at less than 450mA.

Clock requirements are met by connecting a crystal directly to two pins. Alternatively, out of phase signals from an external clock generator can be used. The remaining pins are divided into four functional groups, as detailed below.

The first thirteen pins connect to the instruction address lines, and allow up to 8192 words of program to be directly addressed. The next sixteen pins are the instruction word lines, allowing sixteen bit instructions to be passed to the processor.

Another eight pins are used for data memory and I/O purposes. Designated as the interface-vector (IV) bus, these allow data to pass from and to the processor. The remaining pins are used for IV bus control, and halt and reset functions.

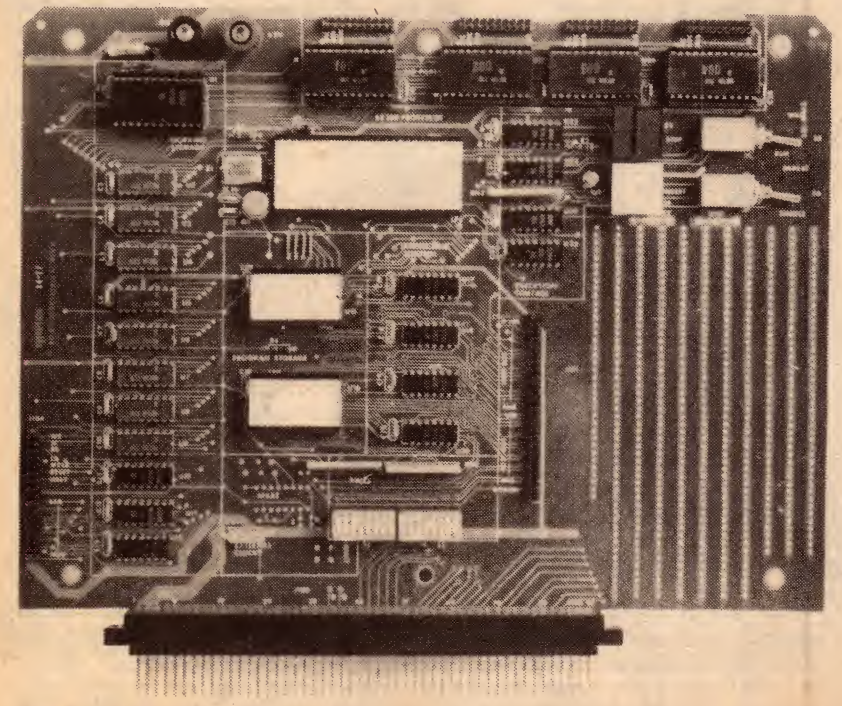
The chip includes full instruction-decoding logic that interprets the particular class of instruction, such as input/output or arithmetic and logic, and performs the indicated operation. The decoding and control logic supplies all internal signals for the processor, as well as signals on the control lines for directing the data input and output.

The processor also contains its own program counter which is automatically incremented upon execution of the instruction. The counter may also be left unchanged or loaded with a new value. Control of the current address is provided by the address register and may be derived completely or partially from the program counter, from the instruction data lines (AR_0 through AR_4), or from the output of the arithmetic/logic unit (lines AR_5 through AR_{12}). Because of this flexible instruction-address scheme, the order of execution may be altered by instructions or under conditions determined from selected data.

The processor manipulates 8-bit data bytes. Internal data is stored in 8-bit read/write registers—R_1 through R_6, R_{11}, and an auxiliary register. The auxiliary register holds one of the operands used in two-operand instructions, such as ADD or AND, and a single-bit overflow register stores the carry-over bit from additional operations.

Interfacing with external circuitry is through an 8-bit bus called the interface-vector bus and consisting of lines IV_0 through IV_7. The bus carries both address and data information, and the accompanying data-I/O control lines tell the external circuitry which of the two types of information is on the bus. These lines include write- and select-control, right- and left-bank-signal, and master clock lines.

Since the interface-vector bus carries addresses as well as data, I/O ports on the external circuits must be enabled before data transfer can take place. This is usually accomplished by placing an address on the bus under program control and then activating the select-control line, which indicates that a valid address is on the bus. When presented with an address, each of the possible



The evaluation kit includes 256 bytes of RAM and 512 words of PROM.

512 I/O ports (two blanks, each of 256 addresses) either enables itself upon identifying the address as its own or disables itself if the addresses do not match.

Within the processor, the interface-vector bytes are addressed in a unique fashion. Each byte has an 8-bit field-programmable address. When a given address is selected, the byte is automatically designated, and the 8X300 can then communicate with the I/O device. Moreover, once enabled, the addresses remain so until the processor changes them. This direct addressing feature is especially convenient if a few ports are to be accessed frequently. However if the time required for this operation is an imposition on the user, instruction memory can be extended so that the selection of ports is automatic upon instruction fetch.

The interface-vector bus is partitioned into two banks, allowing the 8X300 to select ports dynamically. The processor uses the left-bank (LB) and right-bank (RB) data-control lines as master enables for the I/O ports, as shown in the typical interconnect scheme of Fig. 1. Any two I/O ports can be active at the same time provided they are on opposite banks, and the ports recognize address, data, and controls only when enabled by the bank signal to which each is connected. Bank partitioning can thus be considered a ninth address bit that is alterable by the processor within an instruction, and it is this additional bit that permits direct addressing of 512, or 2^9, I/O ports.

In a general data operation between two I/O ports, first an address is presented to one bank that enables an I/O port and disables all others on the bank. Next, another address is presented to the opposite bank, effecting a similar selection there. Then the operation between the two takes place.

Each 8X300 operation is executed in one instruction cycle (250ns), which is divided into four quarter cycles. The instruction address for an operation is presented at the processor output during the third quarter of the previous instruction cycle, and the program memory returns the instruction to the processor during the first quarter cycle.

In terms of processing data, the instruction cycle may be viewed as having two halves, an input and an output phase. During the first half of the instruction cycle, data is brought into the processor and stored in an interface-vector latch. Storage is completed during the first quarter cycle, and in the next quarter cycle the data is processed through the ALU. In the second half cycle, the output data is presented to the bus and finally clocked into the designated I/O port.

Bank selection during the input and output phases is independent. Thus data may be received from the right bank, processed, and then deposited in the left bank or vice versa, or may even be sent to and from the same bank. Bank selection during instruction cycles is specified by the instruction.

Each sixteen bit instruction is divided into one of eight possible classes. The MOVE instruction allows the contents of selected registers to be exchanged, or placed on the IV bus, or vice-versa. The ADD, AND and XOR instructions are similar, except that with these instructions the contents of the auxilary register are combined with the source register before the MOVE part of the instruction is executed.

The XEC instruction allows a selected instruction at a different address to be executed without incrementing the program counter.

The NZT instruction allows a conditional branch to be implemented, while the JMP instruction implements an unconditional branch.

The remaining instruction class, XMIT, allows a binary pattern specified in the instruction to be placed in a specified register or on the IV bus. It is similar to a load-immediate instruction.

As you can see from Fig. 1, the main peripheral chip required to implement a typical working configuration, apart from ROM and RAM memory, is the 8T32 dual port register. This is an 8-bit bidirectional data register, which is accessable via either a microprocessor port (normally connected to the IV bus), or a user port.

A unique feature of the 8T32 is the way in which it is addressed. Each device had a field programmable 8-bit address, which is used to enable the microprocessor port when that address is present on the IV bus. A control signal (select control) is used to distinguish valid addresses from data.

Enabled ports remain open until another valid address is presented on the control line. Two 8T32 devices which have been selected simultaneously can be differentiated from one another by means of the LB-bar and RB-bar lines, which separate the IV bus in two banks.

The evaluation kit for the 8X300 consists of a single large printed circuit board, measuring 280 x 210mm. It is fitted with an edge connector and matching socket on one edge. Included with the 8X300 chip are four 8T32s for external interface, 256 bytes of RAM for working data storage, and 512 words of PROM program storage.

Part of the PROM is programmed with I/O control, RAM control and RAM integrity diagnostic programs, with the remaining space being left free for user programs. Access is available to all address, instruction and IV buses as well as all controls and signals of the 8X300 itself. An area of the board is provided so that additional circuitry can be mounted using wire wrap techniques.

Controls are also provided for diagnostic and instructional purposes by allowing various operating modes, such as single stepping, instruction jamming and repeated instruction jamming. In these latter cases, the jammed instruction is selected by means of board mounted DIL switches.

An 8X300 programming course is also available. This consists of a large folder of written material, and is accompanied by 10 pre-recorded cassette tapes which interact with and explain the written material.

In conclusion, the 8X300 chip and its association evaluation kit are both rather specialised and will probably be of most interest to professional control equipment designers, rather than hobbyists. Further information can be obtained from Philips Electronic Components and Materials, 67 Mars Road, Lane Cove NSW 2066.

TYPICAL SYSTEM CONFIGURATION

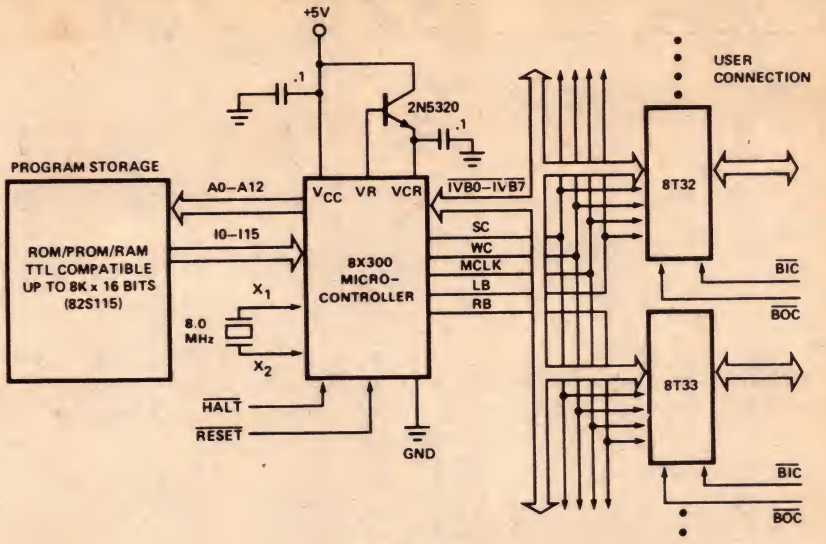


Figure 1

More programs for MINI SCAMP

With many hundreds of Mini Scamps now in operation, quite a bit of software is being generated. Here are some useful utility routines which have been sent to us by interested readers.

The first routine comes from a reader in Cheltenham, Victoria, Mr C. B. Curnow. It is designed to solve one of the main problems in hand assembly of programs: calculation of instruction displacements. Needless to say this saves time and tempers, as well as obviating possible errors.

Mr Curnow introduces the routine as follows:

"Calculating short positive displacements by hand is a relatively simple job. However, when the displacement is negative or greater than the base of 16, one has to be careful to avoid mistakes. I found the article by Peter Lazarus in the August edition of EA of particular help in this regard. Nevertheless calculating displacements in anything but the shortest programs can become tiresome. I hadn't been doing this long before I decided to use the computer itself to help me by doing all the hard work.

"With the program enclosed it is simply a matter of feeding in the address of the instruction, the address of the label, and whether the displacement is for a jump instruction or not. These are fed in via the data switches in succession, in response to the DRQ light. The LEDs will then display the appropriate displacement, which can be recorded.

"The heart of the program is the set of instructions LDI 0, SCL and CAD, which calculate the two's complement of the required number. I have found this little program saves a lot of time when writing programs, and thought it might be of interest to other readers."

The remaining two routines come from a reader in Slacks Creek, Queensland, Mr Mike Nicholls. The routines are designed to be used together, in order to print or display data stored in the Mini Scamp memory at high speed: 9600 baud. Mr Nicholls introduces the routines as follows:

"I thought readers might be interested in a 9600 baud print routine for Mini Scamp and other SC/MP systems. It may be particularly useful to those people who, like myself, have a SC/MP system connected to their video terminal using the EME-1 display module. The program is quite original, being the result of a couple of late nights spent juggling with microcycles and the SC/MP instruction set.

"The main problem encountered in trying to output information at this speed is lack of time to process the data. At 9600 baud, the smallest element is 104us wide. With a 1MHz clock on the SC/MP this means only 52 microcycles in which to serialise data out of the system, and also keep a

```
                ;CALCULATE DISPLACEMENT

0000 08           NOP
0001 C408         LDI    8
0003 35           XPAH   1
0004 C400         LDI    0
0006 31           XPAL   1
0007 C101 NEW:    LD     1(1)
0009 C824         ST     LABEL
0008 8FFF         DLY    255
000D C101         LD     1(1)
000F C81F         ST     INSTR
0011 A81D         ILD    INSTR
0013 03           SCL
0014 C400         LDI    0
0016 F818         CAD    INSTR
0018 F015         ADD    LABEL
001A C815         ST     ADDR
001C 8FFF         DLY    255
001E C101         LD     1(1)
0020 9C04         JNZ    R1
0022 C00D RO:     LD     ADDR
0024 9002         JMP    DISP
0026 8809 R1:     DLD    ADDR
0028 C902 DISP:   ST     2(1)
002A 8FFF         DLY    255
002C 9DD9         JMP    NEW
002E 00   LABEL:  .BYTE  0
002E 00   INSTR:  .BYTE  0
0030 00   ADDR:   .BYTE  0
0031

          ;ENTER DATA WITH REQUEST
           1.ADDRESS OF LABEL
           2.ADDRESS OF INSTRUCTION
           3."1" FOR JUMP INSTRUCTIONS
             "0" FOR ALL OTHERS
```

The routine sent in by C. B. Curnow. It saves time when writing programs by using the computer to calculate the instruction displacements.

```
                ;FETCH CHARACTER

08                NOP
C413              LDI   19
C823              ST    COUNT
C4FF  LOOP:       LDI   255
8FFF              DLY   255
881D              DLD   COUNT
9CF8              JNZ   LOOP
C4XX              LDI   XX
35                XPAH  P1
C4YY              LDI   YY
31                XPAL  P1
C4AA  NEXT:       LDI   AA
37                XPAH  P3
C488              LDI   BB
33                XPAL  P3
C501              LD    @ 1 (1)
9804              JZ    OUT
3F                XPPC  P3
9DF3              JMP   NEXT
C400  OUT:        LDI   0
37                XPAH  P3
C400              LDI   0
33                XPAL  P3
3F                XPPC  P3
0000  COUNT:      BYTE  0

          ;XX IS HIGH ORDER BYTE OF DATA FIELD STARTING ADDRESS
          ;YY IS LOW ORDER BYTE OF SAME
          ;AA IS HIGH ORDER BYTE OF "PRINT 9600 BAUD" START ADDRESS
          ;BB IS LOW ORDER BYTE OF SAME
```

```
                ;9600 BAUD PRINT

08                NOP
01                XAE
C401              LDI   1
07                CAS
C480              LDI   -128
78                CAE
01                XAE
08                NOP
C4F7              LDI   -9
01        LOOP:   XAE
07                CAS
04                DINT
1C                SR
01                XAE
F401              ADI   1
9CF7              JNZ   LOOP
3F                XPPC  P3
```

The two routines submitted by Mike Nicholls. The "9600 baud print" routine is at top right, with the longer "fetch character" routine to the left.

check on the number of bits to go before the word finishes. This tally must be kept, but a memory reference instruction such as a DLD or an ILD, which one would normally use, takes 22 microcycles and hence makes the timing excessive.

"A way out, and the method used here, is to store the count in the extension register. The data is stored in the accumulator, so that either can be operated upon by accessing via XAE instructions.

"Further savings were gained by setting the start bit first, then setting up the data and count in this time. One point to note is that the status register is affected by this routine due to the CAS instruction in the loop. However, it may be saved if desired by using store and load routines either side of the print program. The 9600 baud serial data exits from the FO pin of the SC/MP.

"The program may reside anywhere in memory and may be called from anywhere since it is self-contained. It is intended to be used with 7-bit ASCII code, which is the normal format, and the program prints the data which is in the accumulator when it is called.

"I have also enclosed a second program which may be used in conjunction with the high speed printing routine if it suits the application. The program will run through a data field in memory, printing each character via the 9600 baud print routine until it reaches the end of the data field.

"The data field is assumed to start in the memory at address XXYY. It assumes the 9600 baud print routine is located in memory also, with starting address AABB. The program continues printing until it encounters a zero data byte, which is assumed to terminate the data field. Control is then returned to Kitbug, at location 0000.

"A delay of five seconds is placed at the start of the program, to allow switching the terminal from 110 to 9600 baud before the program begins outputting characters. When control is returned to Kitbug at the end of printing, the terminal must again be switched back to 110 baud.

"A better way would be to have logic to allow software control of terminal baud rate, via special control characters.

"The changes made to the EME-1 module in the video terminal are minimal. All that needs to be done is to change the wiring to the baud rate switch S3 so that it switches between 110 and 9600 baud, in place of the original 110-300 baud function. This simply involves changing the switch connection from pin C of LK13 to pin H."

Well, there you have them. Three useful little items of software for Mini Scamp, by courtesy of C. B. Curnow and Mike Nicholls. Our thanks to them, and we hope other Mini Scamp users find the routines of interest.

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Philips-T.M.C. have the largest radio telecommunication design and development laboratory in Australia which also plays a leading role in S-E Asia and Europe. We are now seeking to further strengthen this facility with the following personnel:

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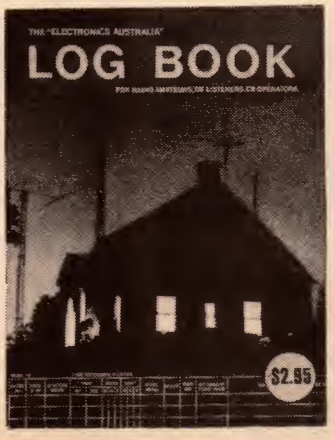

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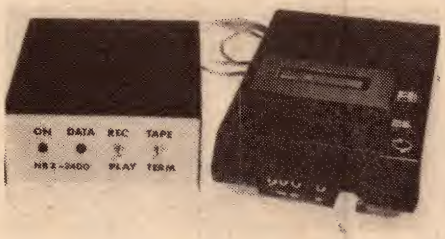
Microcomputer News & Products

NRZ cassette interface

A new digital cassette interface suitable for both hobby and professional microcomputer applications has been released by Computelec, a Western Australian firm. Designated the NRZ-2400, the interface uses the NRZ (non-return-to-zero) recording technique in contrast with the FSK technique used in many current designs. The advantages claimed are greater reliability, and increased tolerance to tape and deck variations.

Features offered by the NRZ-2400 include reliable operation from 110 to 2400 baud, RS232 and TTL compatibility, LED status lights, and compatibility with a very wide range of micro- and minicomputer systems. Normal asynchronous serial data format is used. The NRZ-2400 comes with its own power supply, inside an attractive metal case; all interface connectors are supplied.

To use the NRZ-2400 with a normal audio cassette recorder a minor modification is required. This typically takes no more than about 10 minutes, and involves only a small length of



coaxial cable and a small switch. The switch allows rapid reversion to normal audio recording, so that audio identification may be used for files.

For those who do not have an existing cassette recorder, or who do not wish to modify one, Computelec is able to supply a converted Philips model N2270 recorder as shown in the photograph.

The fully assembled and tested NRZ-2400 interface costs $144.00 plus tax, or $184.00 plus tax with the converted N2270 recorder. It comes with full instructions and a 3-month guarantee.

For further information contact Computelec at 4 Alidade Way, Beldon, WA 6025. Telephone (09) 401-2829.

Speech recognition

Developed and manufactured by Heuristics, Inc. of California, the Speechlab speech recognition interface module is plug-compatible with many of the microcomputers using the S-100 bus system. The module comes complete with a high quality microphone, and provides a speech processing system with programmable spectrum filtering, A-to-D conversion, pattern storage and multiplexing, under the control of the microcomputer.

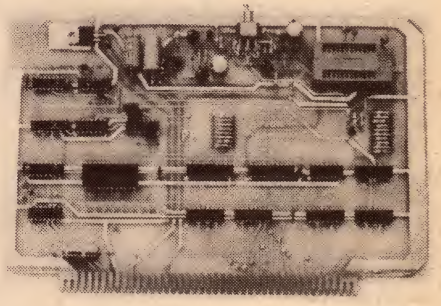
The module provides for a 64-word recognition vocabulary, with each word represented by 64 bytes of coded parameter storage. With suitable software the claimed recognition accuracy is 95%.

Supplied with the Speechlab are a 95-page hardware manual (including schematics), and a 275-page laboratory manual. The latter combines an introductory text on speech recognition with 35 graded experiments using Speechlab.

Also supplied is a software package which includes three complete programs in paper tape form, and seven in source form. The software package includes SpeechBasic, a high level programming language for Speechlab, and an assembly language recognition program.

Price of the complete Speechlab package is $299.00 plus tax and postage if applicable. It is available from the Pitt St Microcomputer Shop, 373-375 Pitt Street, Sydney or PO Box 105, Marrickville, NSW 2204.

PROM programmer



An easy to use PROM programmer module for the popular 2708 EPROMs has been released by Pennywise Peripherals. The programmer is built on a single PC board, and is compatible with a wide variety of microprocessor systems such as the M6800, 8080/5, SC/MP and 2650. The PCB requires only +5V, -12V and +12V supplies; all other voltages are produced on the PCB itself.

In operation the PROM programmer appears very much like a standard RAM. To program each location in the PROM, the microprocessor merely performs a store instruction to the appropriate address. A busy flag indicates when the programmer has finished pulsing the location. Verification may be performed by executing a normal load instruction from the same address. Software requirements are thus very simple.

The PROM may also be read with ordinary fetch timing, so that a program in the PROM may be executed with the PROM still plugged into the programmer.

A zero insertion force socket is used to prevent damage to PROM pins. The

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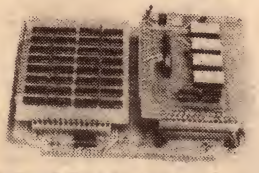

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16 address lines are fully decoded, to allow location of the programmer and PROM in any desired 4k memory block.

The programmer PCB measures 250 x 154mm, and has a gold-plated 2 x 43-way Motorola-type edge connector.

Pennywise Peripherals have also released a new 4k ROM plane, to complement their established RAM plane. The ROM plane takes four 2708 EPROMs or pin-compatible ROMs, and has on-board buffering, decoding and a -5V regulator. The ROM planes can be used with the PP 16k motherboard, and mixed in any proportion with RAM planes.

Price of the assembled and tested PROM programmer is $179.60. This includes tax, but postage and packing is $3 extra if applicable. The ROM plane PCB is $15.75, while a ROM plane kit with everything except the PROMs is $34.90; these include tax, packing and postage within Australia.

Further information is available from Pennywise Peripherals, 19 Suemar Street, Mulgrave, Victoria 3170. Telephone (03) 546-0308, mornings and after hours only.

Data acquisition

Analog Devices has announced a new series of data acquisition and analog output modules compatible with popular microcomputers from Texas Instruments, Pro-Log, Intel, Motorola and National Semiconductors. Each of the units is functionally, mechanically and electrically compatible with its microcomputer counterpart, and contains all of the circuitry necessary to acquire data from multiple analog inputs, or to provide multiple analog outputs.

Various modules in the series provide 16-channel data acquisition with either 8 or 12-bit resolution, and 2 or 4-channel analog output with 8, 10 or 12-bit accuracy, to suit various systems.

For further information contact the Australian agents for Analog Devices, Parameters Pty Ltd, 68 Alexander Street, Crows Nest NSW 2065.

Data recorder

A new ANSI-compatible cassette data recording system that will record off-line and play back directly on a terminal such as the Texas Instruments "Silent 700" has been introduced by Memodyne Corporation. The model 2146 write-only recorder uses standard Philips compact cassettes, and accepts serial data at five selectable rates up to 1200 baud, recording in ANSI/ECMA format. It also accepts parallel data.

The cassettes may be read back with the Memodyne 3765-8 recorder. Recording density is 800bpi per track. Input format for the 2146 recorder is either RS232C or 20mA current loop. The unit measures 270 x 180 x 295mm.

Further information is available from the Dindema Group, PO Box 113, Balwyn, Victoria 3103.

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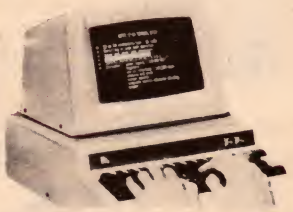
MP-68 COMPUTER WITH 4K MEM.



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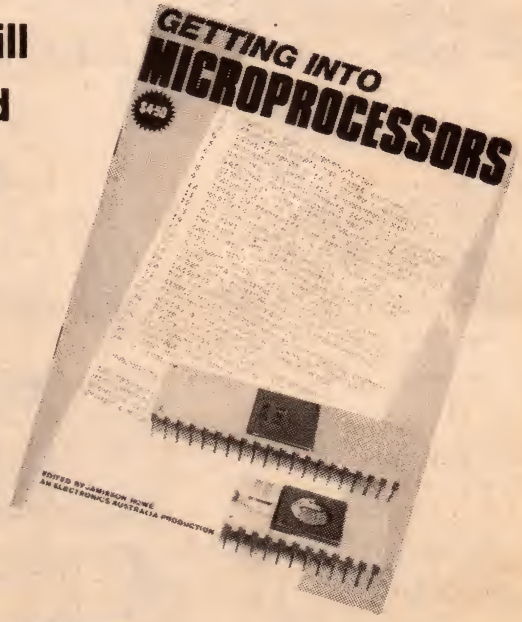

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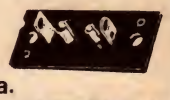

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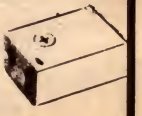

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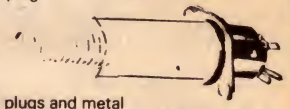

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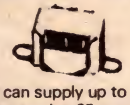

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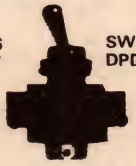

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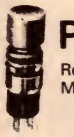

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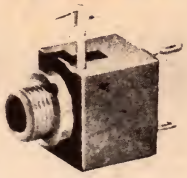

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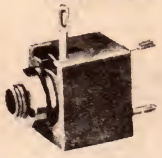

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Classical Recordings

Reviewed by Julian Russell

Tchaikovsky — Symphony No. 5: "among the very best"

TCHAIKOVSKY — Symphony No. 5 in E Minor played by the Berlin Philharmonic Orchestra; conducted by Herbert von Karajan. DGG Stereo Cassette 3300 699. Also available on disc.

Nowadays there are so many good recordings of this symphony, some of them anything but recent and many issued by the same label, that it is difficult to express a really definite preference for one of them. Of course one naturally expects elegance of phrasing from most performances by Karajan and this new version is not without it — nor passion either, though the latter, however intense is never allowed to disfigure the composer's line.

Occasionally Karajan's tempos differ a little from those of other fine conductors' but they always sound just right to me. I refer to the changes of tempo in mid-movement. No matter how drastic the change or dramatic the turmoil, there is never a ragged bar to distract concentration. Moreover everything has an authentic Russian, or rather Tchaikovskian atmosphere.

All through you will hear the most delicately inflected details. It is difficult to imagine the rather starchy mannered Karajan, if not excited himself, generating so much excitement. He offers you the shapeliest of solo horn passages in the slow movement and there is nothing stringy in the tone of the delicately played oboe that follows. Here is the great Berlin Philharmonic at its best.

I thought the waltz movement could have been made to sound ever so slightly gayer to contrast it more against the other three movements. Yet even at Karajan's tempo it has such refinement that it never fails to charm.

Some of the passages are played with an immaculate fragility that I cannot recall ever having heard before in this work. And I was happy that Karajan allowed a reasonable pause after the end of this movement to give one time to adjust one's mood to the solemn opening bars of the Finale. Karajan takes the Finale at an exciting pace without any sacrifice of refinement.

The whole symphony is an example of the great Berlin Philharmonic at its very best and the engineering is great. Whatever other versions already exist or are likely to be issued in the future this one is certain to remain among the very best.

Then there is the bonus of Tchaikovsky's Marche Slave. This is one of the very first pieces I heard when HMV started to record electrically during the middle of 1926. Stokowsky was the conductor and the Philadelphia was the orchestra, and everyone I knew at the time was overwhelmed by the improvement on the old acoustical method.

Stokowsky's reading was blazingly martial. Karajan's is not quite so strictly military, and the staccato brass passages so much admired in the old 78 are not quite so prominent. But it's fine sound for all that and I can not be sure at this distance of time that Stokowsky's performance was as remarkable as one then thought it.

☆ ☆ ☆

MOZART — Symphony No. 40 in G Minor. Symphony No 41 (Jupiter) in C Major. Vienna Philharmonic Orchestra conducted by Karl Bohm. DGG Stereo Cassette 3300780. Also issued on disc.

How could I not write anything but praise for a combination of Mozart, the Vienna Philharmonic and Karl Bohm. The orchestra is at its glorious best, and one feels that the performance is always in the safest of hands.

Some might think Bohm takes the first movement a little too slowly but the intelligent listener will soon discover the reason for this. The G Minor, despite its great weight of passion, is not a romantic work — or perhaps to put it better, it is not a product of the romantic school, and Bohm always keeps it well within 18th century style. His tempo may well be described as truly classical for there is little that is rococo in this great work.

There is nothing frenetic, though there is always plenty of drama. It is all that Nietzsche would have described as Apollonian with form and content always in perfect balance. But don't think you'll find it pedantic. It's much too exciting for that. The engineering is superb. There is not one detail that is not given its exact weight and significance.

The slow movement I can only describe as seraphic. There is never a moment of over-expression no matter how tempting the material. This, I felt, must be the definitive recording — and I still think so

The sturdy control of the minuet really made me sit up. And the change of mood in the trio section is as expressive as can possibly be imagined — at any rate by me. And all this produced by an octogenerian.

With a few exceptions great conductors seem to live as long as priests. But don't think conducting is not strenuous, even when one uses a small beat like Bohm's. And remember that the energy expanded at a performance is nothing like what is needed at rehearsals.

I can only write here that this recording is perfection. What more can I add? The Jupiter has all the merits of the G Minor.

By the way, have I ever mentioned before that the key signatures of the four Brahms symphonies — C,D,F and E — are the opening notes of the Finale of Mozart's Jupiter Symphony? An accident? I wonder.

☆ ☆ ☆

SIBELIUS — Symphony No. 2. Boston Symphony Orchestra conducted by Colin Davis. Philips Stereo Cassette 7300 518. Also issued on disc.

This is an outstandingly sensitive performance that never ignores any of Sibelius' characteristic hints of gauntness. Perhaps the first movement is slightly romanticised, and in it the composer's superb brass writing gets a real go.

Yet freely interspaced you will hear passages of the most moving tenderness. The attack is everywhere knife-edged and the orchestral soloists are beyond praise. The sound is good but I wouldn't describe it as out of Philips' top drawer.

The spectral beginning of the second movement is an object lesson in the control of dynamics, with the change from pizzicato to legato quite magical. To those who hold the opinion that it is

not quite stern enough I can only reply by pointing out the consistent beauty of the sound. The pauses between the various passages are always perfectly judged; the quicksilver flow of the Finale would easily represent a Finnish-born Hermes on an urgent message; and the bewitching contrast of the new slow section might fancifully be thought of as the recipient of the message reading it. It is a beautiful piece of sheer lyricism. And the passionate Finale is always thrilling.

It is my opinion that this performance will never fail to charm you. But quibblers may claim that in Davis' interpretation the prevailing climate of Finland is not as cold as Sibelius music usually conveys. But there always remains the argument that the 2nd Symphony is one of the composer's most genial. A comparison between this symphony and the Fourth will immediately illustrate what I mean.

☆ ☆ ☆

BRAHMS — Piano Concerto No 1 in D Minor. Roger Woodward (piano) with the new Philharmonia Orchestra conducted by Kurt Masur. RCA Red Label Stereo Disc. RL 20351.

What a man of surprises is Roger Woodward. In his claims to get to the very roots of the pieces he is studying he finds revelations that, when he passes them on to his audience, sometimes make Chopin sound like Beethoven and Brahms occasionally sound like Chopin. He can be wilfully perverse, as was demonstrated in this column recently when he played the first movement of Beethoven's Moonlight Sonata without once releasing the pedal from first to last bars. At other times he can play anything he attempts quite angelically.

An explanation might be found in his profound interest in advocacy of avant garde music, which is always seeking new notions. Rarely can they be called musical ideas. But whatever the reason this concerto is a case in point, the common treatment of which is to emphasise its bigness.

Woodward seems to deliberately avoid anything like this.

While in no way miniaturising it, he concentrates — successfully I might add — on extreme refinement. This is made manifest in the very first bars he plays. They are gentle and expressive and are a delight to listen to. But he sticks to this style throughout most of the rest of the work. He eschews anything that might suggest overweight. Even the concerto's most massive climaxes are held under the strictest of control. There is never a question of anything in the way of abandon. As far as is possible he maintains strict tempos. If there were space here I could cite many examples of this iron willed determination — lack of technical resources are certainly not responsible. He can, if he likes, hammer out without a wrong note, the most ferociously heavy passages.

Those who attended one of his recitals in the Sydney Opera House a couple of years ago might remember his thunderous performance of a Chopin Scherzo. It was aurally most impressive — but as the French general remarked: "Was it war?" Yet in the concerto under review he goes almost to the other extreme.

But when this strongmindedness — some might even go so far as to call it bloody-mindedness — is in one sense to be admired, it suggests a reading so different to what is generally regarded as acceptable that it will be bound to have its admirers — at a guess especially among younger musicians. One can listen ecstatically to the delicacy of touch that characterises so much of the performance, but one does miss the excitement of the contrasting weighty passages.

His articulation is, as usual, perfect and the whole performance is to be admired as an example of Woodward's unshakeable conviction that this is the way it should sound. To many ears it wouldn't sound quite right — always excepting, of course, his seraphic pianissimos. Yet strangely, within its own proportions, there are no lack of contrasts. It is a puzzling performance expressing a new idea of the work, sometimes with impressive success. But on the whole, it lacks excitement.

Dvorak: "something well worthwhile"

DVORAK — Symphony No. 7 in D Minor. Concertgebouw Orchestra conducted by Colin Davis. Philips Stereo Cassette 7300 535. Also available on disc.

Davis' first bars don't promise anything out of the ordinary, but once finished you realise from the freshness of his attack on the movement proper that here is going to be something well worthwhile. He gets a springiness here and there that reminded me of some of the late great Szell's readings of this composer's work.

Another outstanding feature of Davis' performance is the clarity of his orchestral balance which he never allows to thicken. Davis displays a little more obvious panache than the severely classically minded Szell. He has tons of zest which he contrasts in masterly fashion against passages of ravishing fragility. I think his slow movement is the best I have ever heard.

His dynamic variations are countless but always in the best possible taste. The same goes for his very slight changes of tempo, so subtle that they pass almost unnoticed at first hearing.

If you repeat this movement, the combination of the conductor's skill and the orchestra's generous response become more apparent — and enchanting. The engineering is faultless and the acoustics of the old Concertgebouw Hall, in which this recording was made, need no reminding from me that it is one of the world's best. I won't go quite so far in my praise if you attend a live performance in the hall. The sound, of course, is just as splendid but if you are unlucky you will find yourself sitting behind a post.

Davis' account of the scherzo has an irresistable lilt. To me the trio selection loses a wee bit of its effectiveness in its close approach to tameness, but the sparkle of the rest of the movement makes ample compensation.

In the Finale Davis' severe control of the brass — except in the grand horn section — gives it here and there more of a Brahmsian atmosphere than usual. But towards the end Davis relents and allows the brass to blaze in full splendour.

You may find Davis' reading occasionally rather different from the more conventional treatment in recordings of the symphony you may already own or have heard. But I cannot imagine anyone failing to love it.

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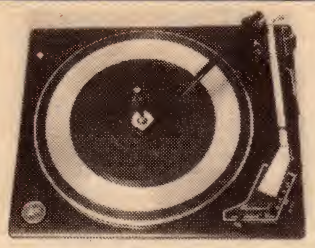

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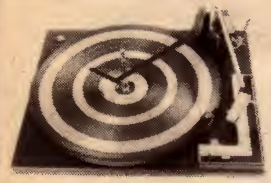

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Lighter Side

Reviews of other recordings

Devotional Records

THE MIRACLE. The Piano Artistry of Dino & David Rose and his Orchestra. Stereo, Light LS-5720. (From Sacred Productions Australia, 181 Clarence St, Sydney and other capitals).

Dino, born in New York of Greek parentage, and still a young man, has won wide acclaim for his Gospel concerts in the USA and Europe and for his weekly nation-wide TV program. He is backed here by David Rose and his orchestra in a program of music intended to depict "The Miracle" of someone who has experienced personally the power of God in their lives. The titles will be well known to most: Amazing Grace — The Saviour Is Waiting — The Last Mile Of The Way — I Believe — Oh Happy Day — The Old Rugged Cross — He's The Savior Of My Soul — Bridge Over Troubled Waters — The Miracle.

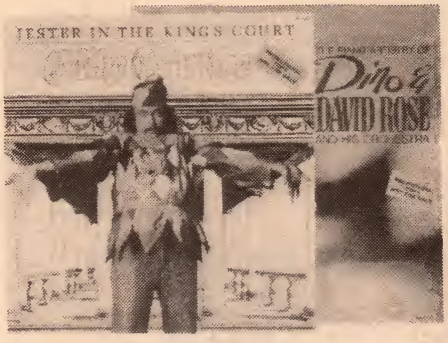
Dino's piano style is basically gentle and intimate ("cocktail" piano?) but interspersed with ornamented passages and building to the occasional climax. And this is complemented by the predominantly string orchestra of David Rose, also ranging from the intimate to the dramatic.

In terms of sound quality, the piano part is satisfactory but the strings have a somewhat edgy quality that will reduce the album's appeal to the dedicated hifi buff. But this will pass unnoticed by the average listener more interested in a personalised performance of nine well known devotional songs which together add up to the "Miracle" story. (W.N.W.)

☆ ☆ ☆

JESTER IN THE KING'S COURT. Mike Warnke. Stereo, Myrrh MSA-6589. (From Sacred Productions Australia, 81 Clarence St, Sydney and other capitals).

Well, here it is: the most unusual Gospel record that I have yet had to review in these columns. The photographs suggest a bespectacled, stockily built young man dressed in the unlikely combination of jeans and a jester's jacket, against a line drawing of



ancient columns and things. Add that to some weird track titles and you don't know what to expect.

On the start of Side 1, someone introduces Mike Warnke as the worlds funniest Christian comedian and that really puts one off: there aren't too many entertainers who can be really funny on a record and a christian comedian surely isn't going to be one of them!

But Mike Warnke gets it together real fast, man. The studio audience rapidly warms to his uninhibited teen-twenty style, and so will many of you. But tucked in amongst the cracks and asides is the personal testimony of someone who was into drugs and a lot of other things he don't like talkin' about. Now he's a christian he's learnin' to really love people — even guys with short hair! But he does get impatient with those so-called christians who seem to spend their whole lives just doin' the "donts"!

In fact, the first side is an ingenious and entertaining mix of mod. style idiom and humour, with the basic christian values.

But having won the attention of his audience, Mike Warnke, on side 2, launches into a highly emotional retelling of the crucifixion, and a highly allegoric account of the spiritual conflict behind the event.

Attention is turned back on the listener in a traditional evangelical challenge but I can forsee arguments as to whether Mike Warnke is cheapening the Gospel, or putting on a well rehearsed spiel, or communicating to the teen-twenties in a way that no traditional evangelist could do.

Excellent discussion material for any group interested in Gospel communication. (W.N.W.)

Instrumental, Vocal and Humour

RULE BRITANNIA. Royal Liverpool Philharmonic Orchestra conducted by Sir Charles Groves. SQ encoded. OASD 3341. EMI release.

This record was specially commissioned to commemorate the Silver Jubilee of Her Majesty Queen Elizabeth II. It consists of various excerpts from well known English patriotic music. The tone of the whole record is set by the first track, Elgar's "Pomp and Circumstance March No. 1 in D Major", which is one of my personal favorites.

Composers represented in the following tracks include Holst, Vaughn Williams, Walford, Davies, Coats, Bliss and Thomas Arne. The concluding track is a memorable rendition of "Rule Britannia", with Anne Collins and the Liverpool Philharmonic Choir.

I was unable to evaluate the SQ quadraphonic encoding, but found the stereo images to be well defined. Recording quality was excellent, with a very transparent sound, and commendably low background noise. I would thoroughly recommend this record to those seeking a good selection of stirring British music. (D.W.E.).

PETER AND THE WOLF. Op67 Prokofiev. CARNIVAL OF THE ANIMALS. Saint Saens. Boston Pops Orchestra conducted by Arthur Fiedler. Narrator, Alec Guiness. Stereo, RCA Gold ANL1-2322. Also on cassette ANK1-2322.

This re-issue by Ethel Gabriel must be the umpteenth album featuring "Peter and the Wolf" which has come to notice in recent years — coupled, as usual, with "Carnival of the Animals". With full narration, handled competently here by Alec Guiness, the story of Peter and the Wolf is undoubtedly a painless way of introducing the young to associate musical themes with identifiable characters and situations.

Carnival of the Animals on side 2 requires rather more of the individual's imagination but is nevertheless non-demanding listening when the novelty of Peter has worn off. Featured on this side are duo pianists Arthur Whittlemore and Jack Lowe, but with orchestral backing. There are no jacket notes but the "animals" are listed in order for the listener to distinguish.

The quality and general balance of the recording is excellent and, if you don't already have another version, you can buy with confidence. (W.N.W.)

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

THE LIGHTER SIDE

GREAT TENORS OF TODAY. Stereo, HMV Diamonds OASD-3302.

Presumably compiled by W. A. Chislett in 1976, this collection of notable tenors and notable arias has drawn widely on the EMI catalog from as far back as 1959. While it would occupy more space than is available to list the items adequately, I will try to summarise them for your guidance — composer, opera and soloist in that order:

Verdi, "Aida", Placido Domingo — Bizet, "The Pearl Fishers", Nicolai Gedda — Giordano, Andrea Chenier, Franco Corelli — Bizet, Carmen, John Vickers — Puccini, "Tosca", Carlo Bergonzi — Verdi, "Otello", four soloists — Puccini, "Turandot", Franco Corelli — Mascagni, "L'Amico Fritz", Luciano Pavarotti — Gounod, "Faust", Nicolai Gedda — Puccini, "Manon Lescaut", Placido Domingo — Verdi, "La Forza Del Destino", Carlo Bergonzi — Saint Saens, "Samson Et Dalila", John Vickers.

The orchestras are all notable in Europe: New Philharmonia, Opera-Comique, Rome Opera House, Covent Garden and so on.

Although from a variety of sources and time periods, the various excerpts have been re-recorded to a generally uniform sound which is entirely adequate. Your response to the release need depend only on your liking for the music. (W.N.W.)

☆ ☆ ☆

NEW RECORDINGS OF THE GREATEST HITS OF ROCK AND ROLL. The new star Don Young and the Memory Machine. Project 3 Quadraphonic LQ-36115.

To those whose ears are jaded with the inanities of today's pop music, the lyrics and rhythms of yesteryear sound just as banal. Probably this is because it is now "old hat". But even after allowing for these feelings, I still have to state that these new versions are lacking by comparison with the original versions, most of which I still have. So listen before you buy.

The track titles are: Johnny B. Goode — My Prayer — Walk Don't Run — Will You Love Me Tomorrow — She Let Her Hair Down — Long Tall Sally — My Girl — I Can't Get No Satisfaction — Rock Around The Clock — You Keep Me Hangin' On — In The Still Of The Night — I Only Have Eyes For You. (L.D.S.)

☆ ☆ ☆

TREES, DOUG ASHDOWN, ASH Records BGLP 1001 Astor release.

Doug Ashdown's recent release is a collection of sad ballads, with songs of lost love and young ideals. The open-out sleeve contains the lyrics for the twelve songs, including: The Saddest Love Song Of All — Throw a Little Sun At The Rain — Halo And Wings — Rowe Street — I Can Almost See Belfast From Here — Places The Trees Should Have Grown — Welcome In Gold.

Some of the musicians involved are: Wayne Findlay, Doug Gallagher, Mark Kennedy, Greg Lyon, Kirk Lorange, Jim Kelly, Tom Sparkes, Bob McIvor — Tony Buddle, Winsome Evans and Gordon Bennett's string players. The overall quality is excellent. (N.J.M.)

☆ ☆ ☆

MAX BYGRAVES. Max-A-Million. ASTOR SPLP 1504.

Max Bygraves recreates a lot of pleasant memories of the great hits of the war years in this very enjoyable record.

There are twenty four titles, including six medleys. Some of the tracks are; Good Morning — Bless'em All — Tangerine — That Old Black Magic — Boogie Woogie Bugle Boy — Five Minutes More — Far Away Places — Let Bygones Be Bygones.

The backing is provided by the Frank Barber Orchestra and the Tony Mansell Chorus, the whole package being worthwhile listening — especially if you can remember those times. (N.J.M.)

☆ ☆ ☆

DAVID GRAY SINGS. Something Old, Something New. M7 MLR 177 Stereo.

The title of this album is very apt, being as it is, a collection of twelve ballads of new and old vintage, each a favourite in its time. Sven Libaek's Orchestra provides an excellent backing to David Gray's voice in: Granada — As Time Goes By — Without A Song — Falling In Love With Love — Bluebird Of Happiness — I'll Walk With God — Evergreen — Born To Lose — By My Love — What I Did For Love — My Way — May Each Day.

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singer together with the first and latest model Holdens, against the backdrop of the Sydney Opera House. In a word enjoyable. (N.J.M.)

☆ ☆ ☆

LOVE KNOT IN MY LARIATE, Mick Antonio. Crest International CRT 12 SLP 039.

Mick Antonio hails from Victoria and has quite a following in his state. Judging by the performance on this record, he deserves wider fame. Together with his sons Brian & Kevin and a group of Australian musicians, he has put together one of the best country and western records I have heard for a long time.

Some of the twelve titles are: Jealous Heart — Don't Ever Be Afraid To Go Home — Fatal Derby — Old Faithful — Tenderly — There She Goes — Losing My Blues — Almost Persuaded.

The record is a production of Sound and Film Enterprises of Australia Ltd and is released through Crest Records, 122 Chapel St, St Kilda 3182. (N.J.M.)

☆ ☆ ☆

NO MORE HEROES. The Stranglers. United Artists L 36370. Festival release.

The Stranglers are a successful group in the British "new wave" of music but the punk sound has not caught on in Australia to the extent it has in the U.K.

Some of the tracks featured are: I Feel Like A Wog — Bitching — Peasant In The Big Shitty-School Mam.

For those who enjoy the punk sound, accompanied by unusual slang, obscenity and the occasional four letter lyric, this album is for you — but no one else. (D.H.)

☆ ☆ ☆

FROM HERE TO ETERNITY. Giorgio. Interfusion L 36418. Festival release

This is Giorgio Moroder's second album, follow-up to "Knights In White Satin". The album was recorded in Munich, Germany.

In it, Giorgio makes use of his unique "Munich Machine", a form of electronic keyboard. You may have heard the sound on Donna Summer's immense smash hit, "I Feel Love", and you'll hear it again in some of the tracks of "From Here To Eternity".

For those who are disco-inclined, this is a stunning record to purchase. (D.H.)

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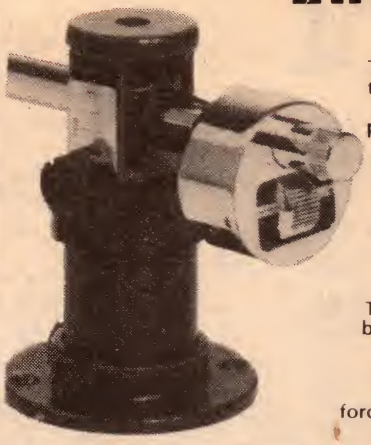

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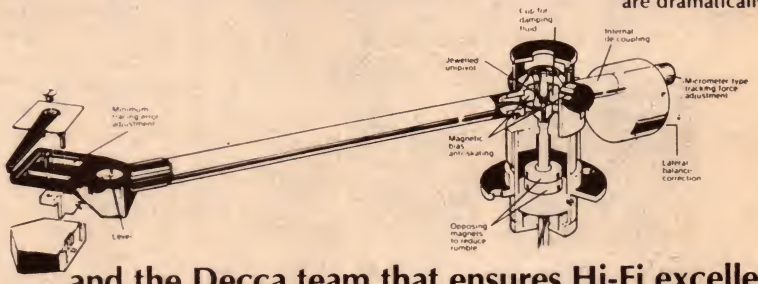

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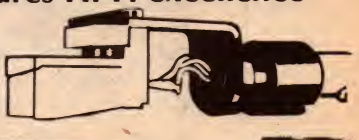

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MARTY RHONE. Marty Rhone. M7 Records MLF 171.

Following on from his "Denim & Lace" album, Marty seems still to be climbing up the ladder of success. The single, "Mean Pair Of Jeans" has been receiving a deal of airplay lately, and is included on this album. Other tracks are as follows:— Things We Did Last Night — Stuck In The Sand With You — The Reggae Rock — Leave While The Music Is Still Playing — On The Loose — Life Is A Three Ringed Circus — If You Want It Baby — I Don't Want To Say Goodbye — Dial A Dream — I Found Love With You — The Magician's Lost His Partner.

Recording quality is excellent, with minimal surface noise. Overall, I found the album to make pleasant listening, but could not single out any one track in particular. (D.W.E.)

☆ ☆ ☆

ENCOUNTER. Mark Holden. EMC-2614. EMI release.

The opening track "Reach Out For The One Who Loves You" was originally released as a single and became a national Top 10 hit. The second single released from the album "Let's Go Dancing" is likely to perform as well as the first.

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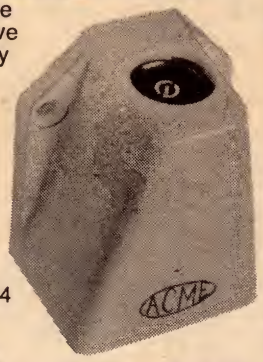

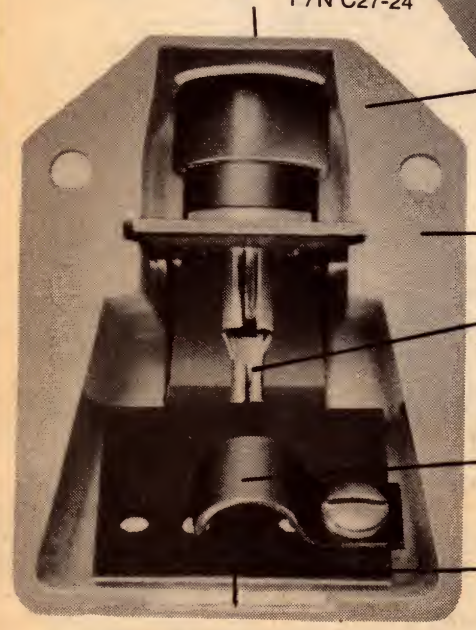

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THE LIGHTER SIDE

STEREO TEST RECORD. "Stereo Review", Model SR12, For Home and Laboratory Use. (From M. R. Acoustics, PO Box 110, Albion, Qld 4010).

This is a highly interesting test recording sponsored, in the first instance, by the American hifi journal "Stereo Review". It is particularly interesting because the whole of side 1 is taken up with tracks which allow a keen listener to assess his hifi system by aural means, and without the use of test equipment.

Bands 1 and 2 respectively break the spectrum up into 20 half-octaves of warble tones, each half-octave being played three times interspersed with samples of the reference half-octave 920-1280Hz recorded at three levels, —5dB, 0dB and +5dB. By playing through these tracks a couple of times to learn what to listen for, it is possible to evaluate subjectively whether the various half-octaves are significantly above or below the 0dB reference. The value of the test is that it involves the entire system; the disturbing part is that it may bring home to older listeners the inevitable effect of the passing years on high frequency perception!

Succeeding tracks of side 1 permit a subjective evaluation of channel separation, cartridge tracking at high and low frequencies, channel balance (by wide band noise), speaker phasing, hum and rumble content, and turntable flutter. A comprehensive leaflet explains what to do and what to look for.

Side 2 is intended more for the laboratory and includes a 1kHz square wave, a response measurement track from 500 to 20,000Hz, a tone burst track, intermodulation tests, an anti-skating adjustment track, 1kHz reference tones at specified velocities, 3000Hz flutter test track, gunshot recordings for stereo spread, a musical A=440Hz reference, a chromatic octave and guitar tuning tones for E—164.81, A, D, G, B and E—659.26.

A lot of thought and care has obviously gone into the production of this disc and it should be a very handy one to have around, as the title says: "For home and laboratory use." (W.N.W.)

Mark Holden composed three tracks out of the 10 which appear on "Encounter" and shares another two with other composers. He also tries his hand at arranging the closing track: "Took My Heart To The Party".

The style of "Encounter" is more mellow than previous releases, but nevertheless, contains some excellent tracks like "Love Enough" and First Thing In The Morning".

Following the early success of this album, Mark has decided he is ready to implement new musical directions. The album itself is a brilliant Australian recording. (D.H.)

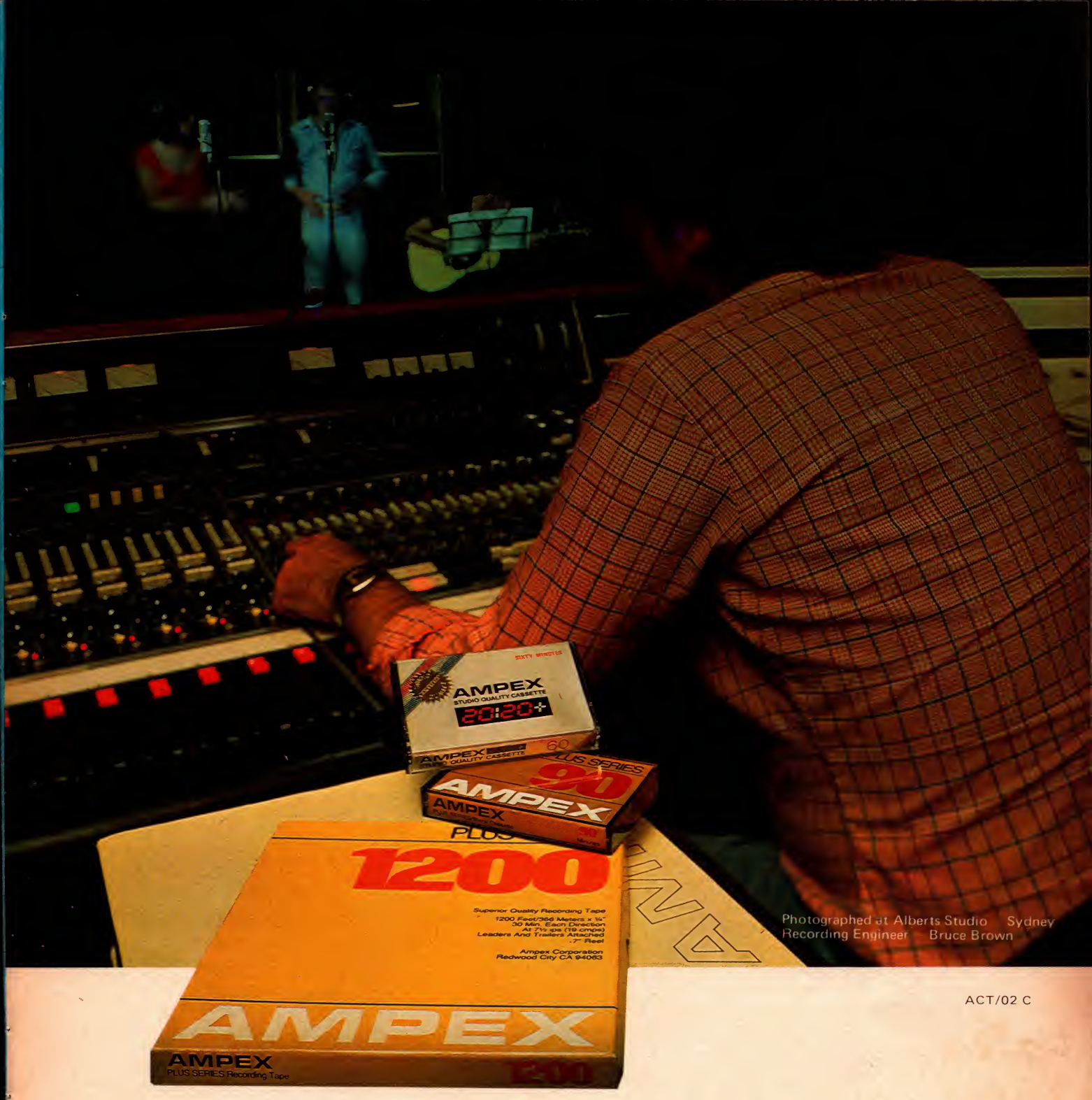
☆ ☆ ☆

IT IS TIME FOR PETER ALLEN. Peter Allen. A & M Records. L 45763/4. Festival Release.

Peter Allen's third recording is a double, live set. The recording took place in New York and Los Angeles.

There are 16 tracks on this album, including his No. 1 smash hit "I Go To Rio" and his follow-up single "The More I See You". While the studio recordings for these two tracks are of a much higher quality, this album nevertheless brings you into the vivid atmosphere of a Peter Allen concert.

Two excellent tracks are: I Honestly Love You and Quiet Please, There's A Lady On Stage. The former is the Grammy Award winning song for Olivia Newton-John, written for her by Peter Allen, and the latter is a dedication to the late Judy Garland, Peter's mother-in-law. (D.H.)



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*HFIA Survey figures Sept. 1977.

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HA109/78

The Australian CB SCENE

CB INTERFERENCE AND WHAT TO DO ABOUT IT

Whatever the pleasures and advantages available to the users, CB radio is gaining an unenviable reputation with the public at large as something that interrupts their TV viewing and their hifi-stereo listening. Why all the complaints about CB interference and what can be done to reduce the problem?

by NEVILLE WILLIAMS

While interference from CB tranceivers is undoubtedly a problem, some of the stories that are published are more spectacular than they are credible. For example, one report in a Sydney Newspaper, told of a woman resident in the western suburbs, whose toaster has the habit of talking CB jargon to her every morning; it "then flares up and burns the toast".

Unlikely gadgets that have talked and played tunes are about as old as radio transmission itself. The broad pre-requisites are a strong radio signal, a metal object that can pick up the signal, a slightly corroded junction to provide a "detecting" effect to isolate the voice or music and to set up a corresponding electric current, plus some kind of a panel which will vibrate in the presence of such audio current.

Talking downpipes, talking stoves, talking radiators, talking bedlamps, &c. have all made headlines at one time or another, being hitherto regarded as a mere curiousity.

So a talking toaster, responding to a local CB transmitter, should not be all that surprising. But there is no way that an ordinary do-everything-yourself toaster, as pictured in the paper could flare up and burn the bread. Not even the most ambitious (and illegal) CB operator could aspire to lay down an RF field as intense as that!

Apart from actual CB operators, the publicity surrounding CB interference has been embarrassing for another group of enthusiasts — traditional licenced radio amateurs, often refered to as "ham operators" or "hams".

The reason for their embarrassment is that interference with domestic television or hifi systems, or with essential 2-way radio services, is often blamed, in the popular press, on to "CB amateurs" or "amateurs using CB equipment". The distinction between CBers and licenced amateur operators is lost on reporters and the public alike. Amateurs are amateurs and, if the public is being inconvenienced by their carryings on, something ought to be done about it! Such is the implication.

In fact, licenced amateur operators have always had their own share of interference problems and many have had to fit filters to neighbour's equipment, or otherwise cooperate, in order to minimise unpleasantness. However, whereas interference by true amateur stations has been relatively isolated, that due to CB operation (officially known as the CRS or Citizens Radio Service in Australia) is on such scale as to prompt media coverage virtually every week or so.

There are several reasons for this. The most obvious one is the very large and ever growing number of CB operators, and therefore the number of people who will find themselves next door to — or within the same block of units as — premises where a CB transmitter is being operated. The incidence of interference is bound to be higher, simply on a statistical basis.

One is reminded of the old quip: "brown horses eat more than white horses; there are more of them!"

Another thing is that the frequency at which virtually all present-day CB transceivers operate — around 27MHz — has a high potential for causing random interference. If a strong local 27MHz signal happens to penetrate unshielded audio or receiver circuitry, it is low enough in frequency to affect some valve and transistor stages, with

Typical filters currently being marketed by Tecnico Electronics of 53 Carrington St, Marrickville NSW 2204. From left to right: low pass antenna filter for use with a CB transceiver; loudspeaker line filter for audio/hifi systems; 300-ohm high pass antenna filter for use with TV and FM receivers; signal input filters for hifi phono, tape recorder leads, &c.

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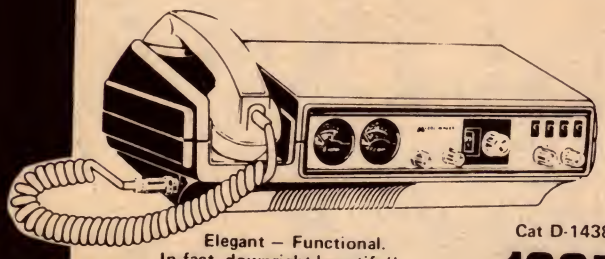

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the possiblity that it can be detected, or modulated on to the desired signal, and thus be heard through the speakers.

As well, low order harmonics of 27MHz, generated by any means, fall within or close to the pass band of television and FM receiver front-ends, again leading to possible interference.

It is for such reasons that the Australian Government is anxious to encourage the ultimate transfer of all CB activities from 27MHz to the UHF band, around 470MHz. Audio circuitry is much less sensitive to this very high frequency and the chances of interference are greatly reduced. Similarly, a UHF carrier and its harmonics are way above the pass band of existing domestic radio and television equipment and, again, penetration and intermodulation is much less of a hazard.

For the time being, however, CB on 27MHz is a fact of life and, to help contain the interference problem, the Australian Government has imposed strict controls over the type of equipment which can be used legally in this country. Based largely on American practice, the only equipment which can be licenced is that approved by the Australian P & T Department. As such, it must satisfy limits set on such things as RF power output, modulation percentage, harmonic or spurious radiation, and aerial gain and height.

While these provisions to reduce the risk of creating interference, they certainly do not provide any guarantee against it occurring. In fact, plenty of the complaints reaching the P & T Department involve CB installations which are perfectly normal and legal.

The unpleasant fact, which has already been highlighted in the USA, is that much of the domestic entertainment equipment, which is currently in use, lacks adequate precautions against possible penetration by strong, extraneous radio frequency energy. The sudden appearance of tens of thousands of CB transmitters around the suburbs has simply shown the extent of the problem.

This, of course, leaves the way open for a great deal of argument. At present, the P & T Department has no jurisdiction over interference into audio equipment nor, in practice, does it have the staff even to mediate. Its resources are fully extended following up complaints about interference into TV and radio receivers and other communication services but, even here, the question arises as to whether it is a transmitter problem or a basic limitation of the receiver. If the latter, it becomes highly questionable whether the CBer should be ordered off the air, despite the "no interference" clause in the licencing conditions.

Without seeking to debate the rights of the parties involved, one thing is certain: the strength of a CBer's position rests heavily on his ability to claim that he is using type approved equipment, and in the approved manner. The moment any irregularity can be shown, it provides an inspecting officer with a ready reason to suspend the CB licence, thus solving the immediate problem!

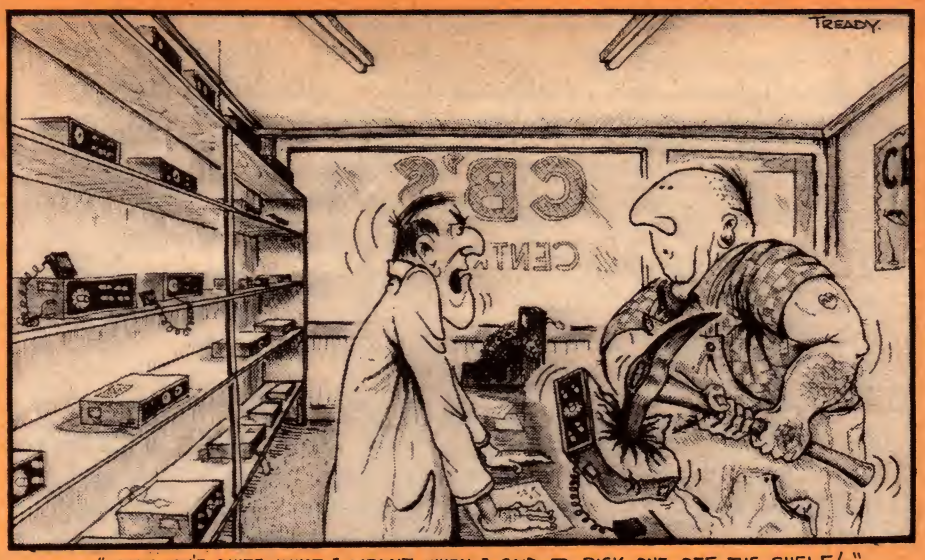
In practice, the chances of CB equipment causing interference — and unpleasantness — in a neighbourhood are greatly increased by what appear to be two fairly common practices, the first being to over-modulate the transmitter in an effort to produce a more "powerful" signal.

Most CB transceivers are sold complete with microphone and have internal automatic gain control circuitry preadjusted to ensure that the carrier will not be overmodulated, even under close-talking conditions. It is not unusual for CBers to substitute other microphones in the hope of finding one which sounds louder than the original.

Or again, some enterprising operator may discover that a similar effect can be had by adjusting such and such a preset in a particular transceiver.

In this context "louder" can only mean deeper modulation, with the strong possibility that it also signifies excessive modulation. The harmonic content of the signal will be increased, along with the risk of "splatter" across all CB channels and into other pieces of electronic equipment. The symptom is an all-pervading kind of "monkey chatter", obviously involving the peaks and sibilants of speech but usually undecipherable.

The second practice which can greatly increase the incidence of interference is that of adding a linear amplifier to the CB transmitter to boost its power above the regulation 4W on AM or 12W PEP on sideband. At the simplest level, the more intense an RF field, the more likely it is to penetrate nearby equipment. More subtley, many linear amplifiers not only boost the



" THAT ISN'T QUITE WHAT I MEANT WHEN I SAID TO PICK ONE OFF THE SHELF! "

(Submitted for the Dick Smith CB cartoon contest by Tony Treadwell, c/- PO Box 170, Merbein, Vic. 3505).

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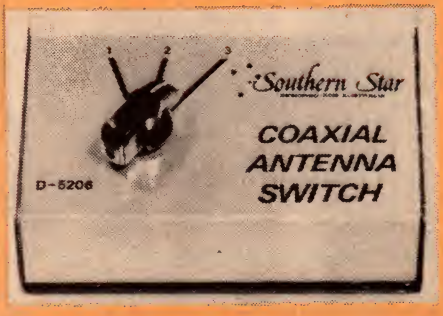

ANTENNA SWITCH: For those who have occasion to do it, swapping antennas or instrumentation to a transceiver or receiver can be a tedious chore.

The alternative is to use a selector switch but not any switch will do, if the SWR is to remain unaffected by its presence in circuit. The Southern Star coaxial antenna switch offered by the Dick Smith Electronics Group is designed especially for the job and, according to the Press release, is suitable for use on frequencies up to 144MHz and at power levels up to 150W. One piece of equipment can be switched to three separate sources or loads — antennas, instrumentation, etc. — and, to minimise interaction, unused circuits are grounded automatically by the switching.

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signal proper, but add their own quota of spurious radiation.

In the face of complaints about interference, therefore, the logical first steps for a CBer are to avoid overmodulation and to discard any equipment or tricks aimed at boosting the RF output power. In general, this means reverting to the original type-approved equipment, including the companion microphone, and operating it from no more than the rated 13.8 volts DC.

If the complaints persist, then you've got real trouble!

Two suggestions are worth following through. The simplest is to fit a low-pass filter in series with the coaxial antenna lead to reduce further the amplitude of any signal components above the carrier frequency of 27 approx. MHz.

Low pass filters are currently available in a variety of shapes, sizes and brands. Usually, however they have an SO 239 socket at each end and require the provision of a short length of 50-ohm cable fitted with a plug at each end. The original coax from the antenna is plugged into one end of the filter, while the extra piece of cable is used to couple the other end to the transceiver.

If the ends of the filter are not specifically marked "Ant" and "Xmitter", it can usually be assumed that they are internally symmetrical and that they can be used either way around.

Specifications for low pass filters typically quote a cut-off characteristic beginning at 30Mhz, and providing an attenuation of from 50 to 80dB above 45MHz, where the television bands start. If harmonic or spurious radiation from the transmitter is contributing to the interference problem, then 50 to 80dB of attenuation will obviously help, and this fact is attested by P & T Departmental inspectors in the field. however, they do make the point that some filters are more effective than others.

While it is good practice for CB operators to fit a low pass filter as a matter of course, the fact remains that it will not solve the problem where interference is the result of direct penetration or intermodulation by the 27MHz signal itself. This passes through a filter completely unaffected.

Curiously, what may help in this case is the installation of an efficient ground-plane type antenna, as high as possible in relation to the general roofline. While such an antenna will have a much increased reach, in DX terms, it may induce a smaller level of signal in the immediately adjacent equipment and house electrical wiring

than a more modest antenna nearer to ground level, where everything is.

In any case, whether using an ambitious antenna or a simple one, try to put as much distance as possible between it and the equipment being affected.

Beyond these measures, a CB operator (or a licensed amateur radio operator for that matter) can do little with his equipment to eliminate interference — apart from switching it off or moving elsewhere, which is what the neighbours might suggest! The other options are all at the receiving end but whether they are exercised, or who by, is often the cause of much argument.

It would appear, as already indicated that many complaints of interference into television and FM receivers is due to straight-out overload of the front end by the 27Mhz carrier. While the front ends will have input circuits tuned variously from about 45MHz to 222MHz, the discrimination against a powerful local signal on 27MHz may not be sufficient to prevent overload of the first stage, with consequent intermodulation effects and visual and/or sound interference.

A similar problem can arise with overload in the distribution amplifiers feeding community antenna systems installed in multi-apartment buildings. Here, there is the interesting complication that the interference affects, not just a single receiver, but all receivers in the building. Pity the CBer who manages to enlist that many aggrieved parties at one go!

Where the problem is direct overload by the incoming 27MHz carrier, some relief may often be gained by including a high pass filter in series with the antenna feedline, preferably close to the receiver or preamplifier. Such a filter will discriminate against 27Mhz or other lower frequency RF input, while passing TV signals at 45MHz or above with virtually no attention.

A commonly available type of unit, as illustrated, is designed for connection into a 300-ohm ribbon feedline. A flat, plastic-encased assembly, it has two leads which connect to the receiver antenna terminals and two screws to take the lead from the antenna.

Unfortunately, equivalent filters for 75-ohm coaxial feedline are few and far between, although they are used by specialist antenna companies and by officers of the P & T Radio Branch in the pursuit of their interference troubleshooting. We understand however that a 75-ohm high -pass filter may be available shortly through Watkin Wynne Pty Ltd, 32 Falcon St, Crows Nest, NSW 2065.

A point worth making is that high-pass filters are most effective when used in conjunction with relatively efficient TV (or FM) receiving antennas. While a large and efficient antenna will doubtless intercept more of the

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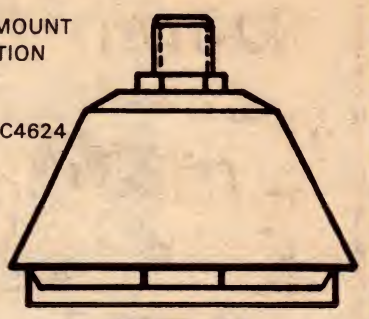

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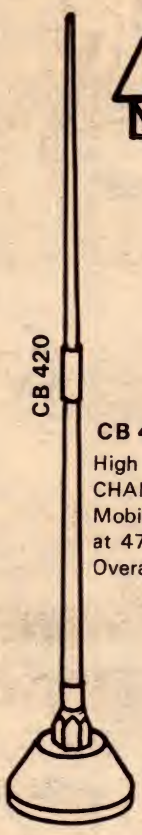

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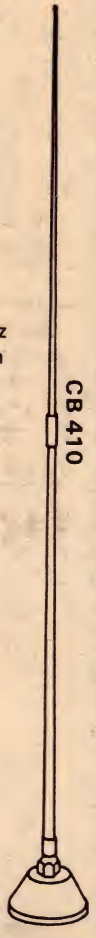

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The Australian CB SCENE

unwanted 27MHz carrier, it may well pick up an even greater share of wanted signal, thereby reducing the relative strength of the interference.

No less important, a strong filtered signal from the wanted transmitter will have a much better chance of swamping CB interference into the mixer or IF stages.

"Rabbit ear" and other similar indoor receiving antennas are, in general, vulnerable to CB interference. They are shaded from the wanted signal, they are not resonant at the wanted signal frequency and their partially vertical elements respond readily to CB transmissions from the usual vertically polarised antenna.

(Readers' attention is drawn to some other remarks on CB interference and TV antennas, in these columns, last month).

One other suggestion often made in overseas literature is that owners of all kind of mains powered equipment suffering from CB interference should try fitting a mains filter, in case the CB signal is reaching the equipment by that route. The suggestion is quite a practical one in countries where there is a ready supply of cheap, mass-produced 110V filters. In Australia, 240V mains filters approved by the supply authorities are much less common and much too expensive for a buy-and-try exercise. If you are desperate, however, an approved 240V 2A Jabel mains filter is available from Watkin Wynne Pty Ltd at the address given previously.

As mentioned, the other major problem area for CB interference is into all kinds of audio/hifi equipment: receiver/amplifiers, record players, tape players, tape and cassette decks, &c.

What usually happens is that the RF signal is picked up by interconnecting leads, or even by the internal wiring of the various inputs and is fed to the first amplifying stage. If the signal amplitude is great enough and there is any suggestion of non-linearity at that signal level, some rectification or "detection" takes place and the modulation becomes apparent as an audio signal. From that point on, it is amplified, just as any other signal would be that was fed into the amplifier.

Not surprisingly, interference of this nature is most likely to occur in equipment having high overall gain, as typically provided to work from a microphone, a magnetic phono cartridge or a tape or cassette deck. It is much more rare in medium-gain audio equipment, as found in simple AM receivers or record players with ceramic cartridges.

As a first step, in the event of trouble, make sure that the interconnecting leads are no longer than necessary for convenience. Make sure also that the shield braid is continuous and effective and that no significant length of signal lead is exposed. Count yourself lucky, however, if you can find and rectify the problem at this level.

The owner of affected equipment who happens to be technically expert can often overcome RF penetration by identifying the input circuit to the first amplifying stage in each channel, inserting a small series resistor (typically 1k to 10k ohms) and bypassing the input electrode to chassis with a small capacitor (typically 47 to 100pF). With a bit of luck, this will attenuate the interfering RF signal, without significantly affecting the audio performance.

In a few cases, supplementary internal shielding can help, particularly in equipment which is not already enclosed in a complete metal shell. Assuming that there is room to do it, a shield may be contrived from tinplate to cover exposed input wiring, and held in place by an existing mounting bolt, a self-tapping screw, or by spot soldering to the chassis.

Fortunately, for those not equipped to probe the innards of hifi equipment (and void markers' guarantees) input filter units are available which can be inserted in series with phone, tape deck and other leads using the RCA type plugs and

sockets. The ones pictured are distributed in Australia by Tecnico Electronics, but there may be other sources.

Curiously, RF interference can often penetrate hifi systems by way of the loudspeaker leads, particularly where these run the full length of a room. The loudspeaker leads, being long and unshielded, act like aerials, picking up the RF energy and feeding it into the amplifier circuitry. It may reach the input system either by stray capacitance or by way of the negative feedback network, being then "detected" and amplified as already explained.

Signal pickup via the speaker leads can usually be checked by moving the speakers close to the amplifier and reconnecting them with very short leads. If the interference disappears or is markedly reduced, the long leads are a problem and counter measures have to be taken.

On some instances, the RF can be blocked by bypassing each active speaker lead to chassis (at the amplifier) with a capacitor of about 0.1uF but, usually, something more ambitious is required. A full-scale toroid loudspeaker filter was described in "Electronics Australia" for June 1974 and in the E. A. Handbook "Projects and circuits" (now out of print).

However, commercial loudspeaker line filters are available, of which the one pictured from Tecnico is typical. These are simply connected in series with the speaker lines, at the amplifier end, taking care to maintain the polarity of the connections.

The remaining possibility is to try a mains filter to feed some or all of the hifi set-up, in case the RF interference is arriving by that route. But, as we remarked earlier, the price of 240V line filters in Australia is such as to deter one from buying and trying!

Interestingly enough, input filters, speaker line filters and even mains filters were not developed primarily as a precaution against CB interference. They were developed originally to protect against cross-talk from radio broadcast and television stations, commercial 2-way communications systems and radar transmitters, along with that most persistant generator of RF oscillatory "plops", the domestic refrigerator! Any efforts spent on proofing a system against CB interference will probably be rewarded by immunity against these other noise sources, as well.

Perhaps one thing only remains to be said, and it isn't very encouraging: If you've tried all the suggestions made in this article without success, you have little choice but to seek professional help:

- From the Radio Branch of the P&T Department, from the distributor or from a competant service organisation, in the case of interference into an AM or FM radio or a TV receiver;
- The supplier or distributor of audio equipment, or a competent hifi specialist in the case of audio/hifi equipment. This is outside the jurisdiction of the P & T Department.

CB ACCESSORIES FROM RALMAR

Ralmar Agencies advise that supplies of CB accessories are catching up, with most items now available ex-stock. In addition to their much advertised "Goldies" UHF connectors, they have a variety of other plugs, sockets, adaptors, fuses, cables and ignition suppression components.. Ralmar also stock a variety of CB antennas and hardware, microphones, speakers and test instruments. A catalog and price list of CB accessories has been available for some time and is still available, post free, from Ralmar Agencies Pty Ltd, 23 Atchison St, St Leonards NSW 2065.

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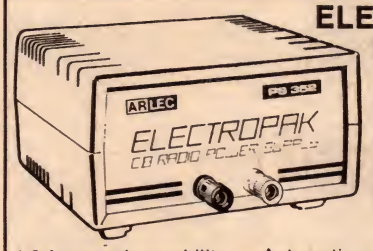

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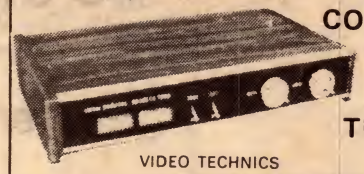

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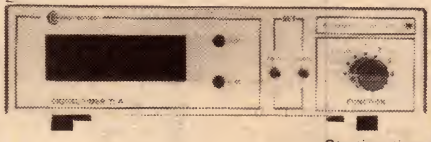

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FRG-7

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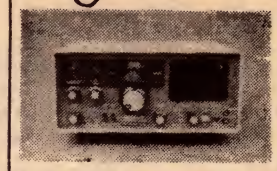

for Amateurs, Novices and Short-Wave Listeners.

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- Stability within 500 Hz during any 30 minute period after warmup.
- Better than 0.7 μV for 10 dB S + N/NSSB and CW.
  Better than 2 μV for 10 dB S + N/N AM.
- Selectivity ±3 KHz at —6 dB, ±7 KHz at —50 dB.
- Input Impedance, high 0.5 —1.6 MHz.
  50-75 Ohm 1.6 —29.9 MHz.
- 234V AC 50-60Hz or 12V DC (external or internal 8 dry cell).
- Size 340 mm x 153 mm x 285 mm.

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8 element & 10 elements **$39.00** (Excellent back to front ratio).

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L=200mm, W=135mm, H=70mm Black vinyl covered, suitable for CB Power supply, etc., ideal project box $3.50••.

••RECOMMENDED RETAIL PRICE (NSW)

AMATEUR RADIO

by Pierce Healy, VK2APQ

Radio club's unique educational experiment

The range of activities associated with amateur radio is almost unlimited. Nor are they confined to the purely technical aspects of communication, but encompass social and community welfare pursuits as well.

Amateur radio caters for a large range of interests other than the technical aspects and person to person on-air contacts. To illustrate how amateur radio can cater for varied interests and community service, here are reports on just a few such activities.

During the latter half of 1971 much publicity was given, in various sections of the news media, to a unique educational experiment. French language students at the Marist Brothers High School, Eastwood, NSW, are using the school's amateur radio club station, VK2ACQ, under the jurisdiction of Reverend Brother Cyril Quinlan, to practice conversational French with Daniel Ludec, FK8KAA, in Noumea, New Caledonia.

In return the students help Daniel and others with their English. Students from the nearby Carlingford High School have also joined in the sessions.

The media snowball started following an article in the local newspaper "Northern District Times" June 29, 1977. This was followed by articles and photographs in the "Daily Mirror" July 5 1977; "The Sun-Herald" July 10, 1977; "les Nouvelles Caledoniennes" August 10, 1977; The "Catholic Weekly" August 11, and September 1, 1977; "En Australie" September 17, 1977; "The Australian Womans Weekly" October 5, 1977; "Daily Telegraph" October 21, 1977 also the September, 1977, issues of "Pacific Islands Monthly" and the "Catholic Education Office Bulletin."

Sydney TV station Channel 7 also gave a good coverage in their Saturday morning session "Funshine".

It intended to continue this activity during 1978 and to include German if a German amateur can assist.

Other achievements by the Marist Brothers' Club were two amateur novice licenses, five YRS elementry stage II, and 22 YRS elementary stage I certificates.

Through the work of Bro. Cyril, and the achievements of the students, the school has received a government grant of $1600 through the schools Commission. This will be used to obtain electronic and project equipment.

Electronics is an approved course for year 11 and part of the technics course in year 9 classes at the school.

Details of the radio club:
Name: Marist Brothers' Eastwood Radio & Electronics Club;
Club call sign: VK2ACQ;
Meeting place: Marist Brothers' High School, 54 Hillview Road, Eastwood;
Day and time: First and third Saturday 1.30pm — 5.00pm;
Affiliation: WIA NSW Division; YRS NDW Division;
Net frequency: 14.160MHz and 7095kHz SSB Wednesday 1.00pm, Saturday 5.00pm;
Contact: Rev. Bro. Cyril Quinlan, VK2ACQ PO Box 129, Eastwood 2122, telephone 858 1644. Membership is not restricted to Marist Brothers students.

A French lesson the modern way! Brother Cyril Quinlan (with microphone) and a group of students who are studying French, via amateur radio, with a French amateur in Noumea. He is learning English the same way.

NOVICE NEWS: The July 1977 amendment allowing novice licencees to operate on the 28.1MHz to 28.6MHz segment has fostered an upsurge in the use of that band. The fact that there is now an increasing number of Australian amateurs using the 21MHz and 28MHz bands, appears to have increased activity among overseas amateurs on these bands, adding a new dimension to Australian novice activity.

As a further enticement to operate on these bands, two awards have been instituted in NSW.

One is issued by a recently formed chapter of a USA based organisation and the other by a novice licensee group in Sydney.

The former award is available to any Australian or overseas amateur. The latter is not available to Australian amateurs.

VK2 BLUE MOUNTAIN-LAGOON 10-X CHAPTER: Formed by a group of amateurs interested in 28MHz operation as sponsored by the Ten-Ten International Net Inc. There are 35 charter members — 30 local and 5 overseas. Associate membership is open to any amateur who acquires the required number of points through contacts on the 10 metre band. Membership is $2.00.

Awards issued for points gained:
VK2 10-X-Certificate : 15 points;
First endorsement (Kookaburra) : 35 points;
Second endorsement (Koala) : 65 points;
Third endorsement (Red Kangaroo) : 150 points.

Awards cost $2.00 for a certificate and $1.00 for each endorsement.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

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FT-101E . . . THE TRANSCEIVER

No need for introductions: the FT101E has been a favourite for years! Full HF band coverage, including 11 metres & WWV/JJY. Built-in 12 volt and 240 volt supplies, comes with mic and fan. Solid state except for driver and finals. 200W unit, provision for fixed (xtal locked) channels. Ideal novice rig, too.

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FT-301 . . . ALL SOLID STATE, 200W

Here it is — the all solid state FT301S. Rugged PA transistors with protection circuitry built in, full HF band (inc 11 and WWV) ideal as a mobile or base unit (with optional FP-301S supply) Single knob tuning, no loading! Well worth that little bit extra. Smaller than the 101E!

$949

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FL-2100B . . . 1.2kW LINEAR AMP

That's right — 1.2kW capability. So you can easily get the maximum legal power out of it. Simple band-switching & tuning, built-in SWR meter. 240 volt supply built in, metering for I_P & I_V. Matches style of FT-101E.

$578

Cat D-2890

FT-227R . . . 800 CH, 2 METRE MOBILE

The exciting new 'Memorizer' unit — instant recall to any channel of 800. Optically coupled dial for readibility, repeater, reverse repeater and tone repeater facilities fitted, as well as simplex. Comes with microphone & mobile bracket, has stand for base.

$375

Cat D-2892

YC-500S . . . 500MHz/1PPM COUNTER

Highly accurate counter goes to 500 megs, at an accuracy of 1 part per million. LED readout, matches the style of other Yaesu equipment. A handy piece of test equipment for any amateur or laboratory.

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OTHER VALUED YAESU GEAR:

FRG7: The incredible Wadley loop receiver giving outstanding performance from 3 to 30 MHz. Now with fine tuning!
Cat D-2850 .. .. $328.00

YO-100: Monitor 'scope ensures YOU are free from harmonics, etc. Handy scope, too.
Cat D-2862 .. .. $279.00

FP-301: Power supply for FT301/S units. 13.5 volts at 20A. Includes speaker.
Cat D-2872 .. .. $175.00

FT301S: 'Short' version of FT301. 20W, less a few features of the full FT301. But look at the saving!
Cat D-2880 .. .. $699.00

FL-110: External booster for FT301S to give full power. Supplied via FT301S.
Cat D-2884 .. .. $249.00

QTR-24: 24 hour ham clock for all world time zones. Easy to read, battery operated.
Cat X-1054 .. .. $33.00

SAVE NOW: Electronic keyer offer

OOPS! We got caught. We bought thousands of dollars worth of electronic Morse keyers o'seas, but found the quality of construction poor when they arrived. Instead of jeopardising our good name, we're going to sell these off BELOW COST! Yes, they work perfectly and are, in fact, brand new. But there's no guarantee, no return.
Save over $50.00 -- were $82.50 each!
Electronic keyer, cat D-7102 .. .. $32.00
(NOTE: Key (paddle) NOT included)

NOVICES: Put your old 'CB' to good use:

Build our novice transverter. Takes the 27MHz output from the CB, transverts it to 80Mx — ends up in novice section of band, too! The cheapest way to get onto 80! Full instructions given.
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17mm — Cat D-4652 . . . . . 80c each.

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AMATEUR RADIO

To qualify for the certificate, points gained must include contacts with a chapter committe member and one local member.

Full details on other chapters and how to accumulate points may be obtained from the chapter secretary, R. Luther, PO Box 183, Eastwood 2122, NSW, Australia.

SYDNEY NOVICE AMATEUR GROUP (SNAG) AWARD: The "SNAG AWARD" is available to any amateur located outside the Australia (VK) call area who makes two-way contact with fifteen (15) novice stations located in NSW.

Contacts may be on any Australian novice frequency allocation.

Mode may be phone or CW.

Endorsements will be given for individual bands or modes.

Applicants should send log extracts of station worked, date, and time to Ern Cornwell, VK2NEC, PO Box 90, Gordon 2072, NSW, Australia. Enclosure of seven IRC's with the application will ensure air mail return of the award. Short-wave listener participation for the award is under consideration.

To mid-January, 1978, 25 award certificates had been issued.

VHF REPEATER NOTES: While other states appear to have currently reached maximum repeater growth NSW is experiencing a great deal of interest and activity in planning for additional installations. These additional services are

Area	Channel	Sponsor
Mt Bindo	1	St George ARS
Cowan	13	Hornsby ARC
Forster	15	Great Lakes ARC
Tamworth	5	N-West Zone WIA
Medlow Bath	9	Blue Mts ARC

The first three are under construction and licenses are provisional, awaiting confirmation from the Radio Branch. All three should be operational by September 1978. The remaining two are licensed, the former is operational, and the latter should come on air by July 1978.

Surveys are currently being conducted in the following areas —

Area	Possible channel
Nimmatabel	1; 4 or 12
Young	4 or 10
Mittagong	15
Goulburn	13; 6 or 14
Moree	1 or 7

RADIOTELETYPE (RTTY): Activity and interest in this mode is increasing in NSW on HF and VHF bands. Here are some points of interest from NSW RTTY group publicity officer, Syd Molen, VK2SG.

Most of the amateur transceivers on the market can be operated on the RTTY mode providing steps are taken to limit the power to that recommended for AM. This is necessary because RTTY is a continuous duty cycle operation.

International amateur standards are: Speed, 45.45 bauds; shift, 170hz; keying, AFSK with the mark the higher frequency; tones, 2125z and 2295hz.

Two methods are used to generate an RTTY signal, one is audio frequency shift keying (AFSK) the easier method, the other, frequency shift keying (FSK). Each have their advantages and disadvantages.

Various types of machines are available in Australia through disposal sources, the most common being the Teletype model 15 and Creed 7B. Syncronous type motors are set to run at commercial speed but the governed type can be easily adjusted to the amateur speed.

(Editorial note:) It is possible to use synchronous motor units for speeds other than that for which they are designed, by means of a speed converter described in "Electronics Australia" for July 1977.)

It is not hard to work 50 countries on RTTY. Apart from European and USA call areas, stations from FR7, OD5, 7X4, C5, 5Z4, 5N2, VP2, 8P6, EA6 are among the regulars.

There are six main contests held during the year, including an RTTY art contest run by the USA. Consideration is being given to a VH/ZL RTTY contest.

The NSW RTTY group meets at Wireless Institute Centre, 14 Atchison Street, Crows Nest on the first Friday of every alternate month. The next meeting will be on 7th April, 1978.

An invitation is extended to attend the group meetings and, to those operating, to call back to the NSW WIA broadcasts at 0030GMT on 14.090MHz and 7045kHz each Sunday.

The WIA has requested that the RTTY mode be permitted to novice licencees.

WICEN TRAINING COURSE: To be held on the fourth Monday of each month at Wireless Institute Centre 14 Atchison Street, Crows Nest at 7.30pm. The purpose is to train and organise WICEN in the Sydney area.

The course consists of lectures and seminars supplemented by instructional and general interest films. Also, lectures by the authorities with which WICEN works are being arranged. It is also intended to provide social activities. WICEN requires your active participation in training courses, monthly meetings, message handling exercises, community service functions and emergency activations. WICEN represents the amateur service in the community at large.

For further information contact NSW WICEN secretary, Alan Nutley, VK2BNA, telephone (02) 230 5122 bus. hrs.

WICEN calling frequencies are — 3600kHz; 7050kHz, 14.100MHz. Sedonary frequencies will be spaced +25kHz for SSB and —25kHz for CW. VHF calling frequency are channel 50 (146.50MHz) or available repeaters. A WICEN working frequency of 145.70MHz (Ch. 34) has also been allocated in NSW.

RADIO CLUB NEWS

YRCS TRIAL EXAM: The Victorian Division YRCS will hold a trial novice examination on Saturday, April 15, 1978, at a venue to be announced.

Applications should be posted to: YRCS Trial Novice Exam, 11 Vista Avenue, Kew, Vic. 3101. The application should include surname and initials, full postal address, and phone number if appropriate.

A fee of $1.00 will be charged to help cover costs and this should be sent with the application as a postal order or cheque. Applicants will be advised of all other details one to two weeks before the exam.

RADIO AMATEURS OLD TIMERS CLUB: Founded in 1976 the club has a membership of about 160 amateurs who have held a licence for 25 years or more.

The annual dinner will be held on Thursday, 9th March, 1978, at the Sciences Club, Clunies Ross House, 191 Royal Parade, Parkville, Vic.

Those wishing to join the club or attend the dinner should contact the secretary, Harry Cliff, VK3HC, PO Box 50, Point Lonsdale, Vic 3225 or telephone (052) 52 1608.

HORNSBY & DISTRICT AMATEUR RADIO CLUB: Has started 1978 with several projects. Theory lectures and Morse code tutorials are held every Monday evening at the Hornsby Evening College, Pacific Highway, Hornsby. These are for the May, 1978 novice licence examination. Morse sessions for limited licencees are also being provided.

Club president Barry White, VK2AAB is involved in costructing a Morse code practice transmitter. This unit will operate continuously on 147.4MHz transmitting various speeds in MCW.

The code will be generated by a micro processor, which will be updated from a specially encoded cassette tape. Material for several days can be stored by this method.

Due to the threat of bushfires in the Hornsby area, the club has organised net frequencies on 10 and 2 metres and has a coordinated plan in the event of emergency communications being required.

The club meets on the first and third Wednesday of each month at 8.00pm in the Normanhurst Progress Association Hall, Cnr. Sefton and Lockerbie Roads, Normanhurst, Visitors are welcome.

On the second and fourth Wednesday of each month, a club net is held, starting at 7.30pm. The net frequencies are 28.400MHz and repeater channel 13. The net control station can provide cross-band communication facilities for

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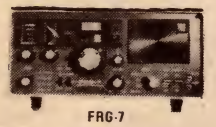

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A must for all Hams, SWL's, Novices and CB'ers.
Uses a 'Wadley Loop' for near crystal controlled frequency stability. 5KHz frequency readout on all bands.

Freq range: 0.5-29.9MHz
Modes: AM, SSB, CW
Sens: Better than 0.7uV for 10dB S/N

All this and more for only $319.

$319.00

LOOK AT THESE PRICES AND COMPARE!!

FT-101E	160-10mx	260W Tcvr	$829
FT-301	160-10mx	200W Tcvr	$868
FT-301S	80-10mx	25W Tcvr	$639
FT-7	80-10mx	25W Tcvr	$558
TS-520S	160-10mx	200W Tcvr	$699
FL-2100B	80-10mx	Linear Amp	$529
FL-110	160-10mx	Linear Amp	$229
FRG-7	0.5-29MHz	Comm Rx	$319
YO-301	301 Series	Monitorscope	$369
YO-100	101 Series	Monitorscope	$253
YP-150	Dummy Load/Wattmeter		$159
502CXX	Heavy Duty Ant rotator		$196
103LBX	Medium Duty Ant rotator		$140
DX-555D	220MHz Counter/Sig gen.		$209

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Looking for more dB's of gain on 20, 15 or 10mx? GFS Swiss Quads give a forward gain of 14dB and a F/B ratio of 26dB. DX galore!!

20mx Swiss Quads $245
15mx Swiss Quads $127
10mx Swiss Quads $118

NEW! DX-555D Combination 220MHz frequency counter and 30MHz Signal Generator. Should be standard equipment in every Ham Shack.
$209

At last!! An HF 80-10mx trapped vertical antenna that comes complete with guy ropes as well radial traps. Maximum radial length only 5 metres. Overall height 6.93 metres. Only $103.

Prices include S.T. prices and specifications subject to change. TRADE INQUIRIES WELCOME

GFS ELECTRONIC IMPORTS: 15 McKEON RD., MITCHAM, VIC. 3132. Ph: (03) 873 3939

AMATEUR RADIO

those participating.

Publicity officer is Gareth Davey, VK2ANF, 28 Redgrave Road, Normanhurst NSW 2076.

WIMMERA AMATEUR RADIO & ELECTRONICS CLUB: Seventy five members, friends, and guests attended the official opening on Thursday 15th December, 1977, of the newly completed clubrooms.

President Bruce Johanson of the Rotary Club, East Horsham, the original sponsors of the club, declared the rooms open following an introductory talk by Bendigo District Radio Inspector, Gilbert Hughes.

WAREC's enthusiastic president Jim Edney, VK3AOE has steered the club since its formation at a public meeting in November 1976. Keith Semmler, VK3ATS and Max Grimble, VK3AR have also given generous support.

A debt of gratitude is owed to John Dennis, VK3ZYG of Stawell for conducting the theory lectures which enabled six members to pass LAOCP and NAOCP exams. During this period Dennis travelled over 3200km between Stawell and Horsham.

The club meets each Monday night and holds training classes on theory and Morse code, films, excursions, and constructional programs.

WAREC rooms are at 20 Wawunna Road, Horsham, Victoria. Visitors are welcome. Further details from Secretary, John Skinner, 39 Edward Street, Horsham, Vic. 3400.

AUSTRALIAN CLUB DIRECTORY

Club name: Brisbane VHF Group.
Club call sign: VK4IF.
Meeting place: Oakleigh Scout Den, High Street, Dorrington, Brisbane.
Day and time: Fourth Thursday of each month at 7.45pm.
Affiliation: WIA Queensland Division.
Net frequency: Channel 8 repeater VK4RBN after WIA news broadcast on Sundays.
Contact: A. Downie, VK4ZRF, 23 Vanburgh Street, Mt Gravatt, Qld 4122.

Club name: Cairns Amateur Radio Club.
Club call sign: VK4HM.
Meeting place: State Emergency Service Building, McNamara Street, Cairns.
Day and time: Second Wednesday of each month at 8.00pm.
Affiliation: Queensland Division WIA.
Net frequency: FM channel 50 monitored.
Contact: Secretary, PO Box 1426, Cairns, Qld 4870.

Club name: Darling Downs Radio Club.
Club call sign: Repeater VK4RDD.
Meeting place: Toowoomba Education Centre, Baker Street, Darling Heights.

AMATEUR RADIO

Day and time: Last Friday of each month (except December) at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: Channel 4 repeater VK4RDD Thursdays at 8.00pm.
Contact: Secretary, telephone (076) 35 1309.

Club name: Gold Coast Radio Club.
Club call sign: VK4WIG and repeater VK4RGC.
Meeting place: Old Surfers Paradise State School, Laycock Street, Surfers Paradise.
Day and time: Second Friday of each month at 8.00pm.
Affiliation: Queensland Division WIA.
Net frequency: 3570kHz Sunday nights at 8.00pm, Channel 2 repeater VK4RGC every morning at 8.00am and Sunday evenings at 7.30pm.
Contact: Secretary, PO Box 588, Southport, Qld 4215.

Club name: Ipswich & District Radio Club.
Club call sign: VK4WIP and repeater VK4RAI.
Meeting place: Club Rooms, Deebing Street, Denmark Hill.
Day and time: Every second Wednesday at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: Channel 6 FM repeater VK4RAI.
Contact: Secretary, PO Box 250 Ipswich 4305 or PRO Bill Jehn, telephone (07) 281 3629.

Club name: Mackay Amateur Radio Club.
Club call sign: VK4WIM.
Meeting place: State Emergency Service Building, Swayne Street, North Mackay, Qld.
Day and time: Fourth Thursday of each month at 8.00pm.
Affiliation: Queensland Division WIA.
Net frequency: 146.5MHz.
Contact: Ron Kerle, VK4EN, 32 Evan Street, Mackay 4740; Allan Mackenzie, VK4ZAN, 4 Laird Street, Nth Mackay 4740, telephone (079) 57 8936; Neil McIntyre, VK4NAP, 6 Harris Street, Beaconsfield 4740, telephone (079) 511381.

Club name: Maryborough Amateur Radio Club.
Club call sign: VK4WIB.
Meeting place: Old Boys High School, Sussex Street, Maryborough.
Day and time: First and third Monday of each month at 7.30pm.
Affiliation: Queensland Division WIA.
Net frequency: 3570kHz and FM channel 50.
Contact: Col Paton, VK4NBP, 225 Pallas Street, Maryborough, Qld 4650.

Club name: Queensland Branch HQ Boy Scouts Radio Club.
Club call sign: VK4QH.
Meeting place: Baden Powell Park, Samford.
Day and time: First Sunday of each month at 9.30am to 1.00pm.
Affiliation: Queensland Division WIA.
Net frequency: 7070kHz 9.30am to 11.00am and 14.290MHz 11.00am to 1.00pm each Sunday.
Contact: Noel Lynch, VK4ZNI, 15 Noeline Street, Dorrington, Qld 4060.

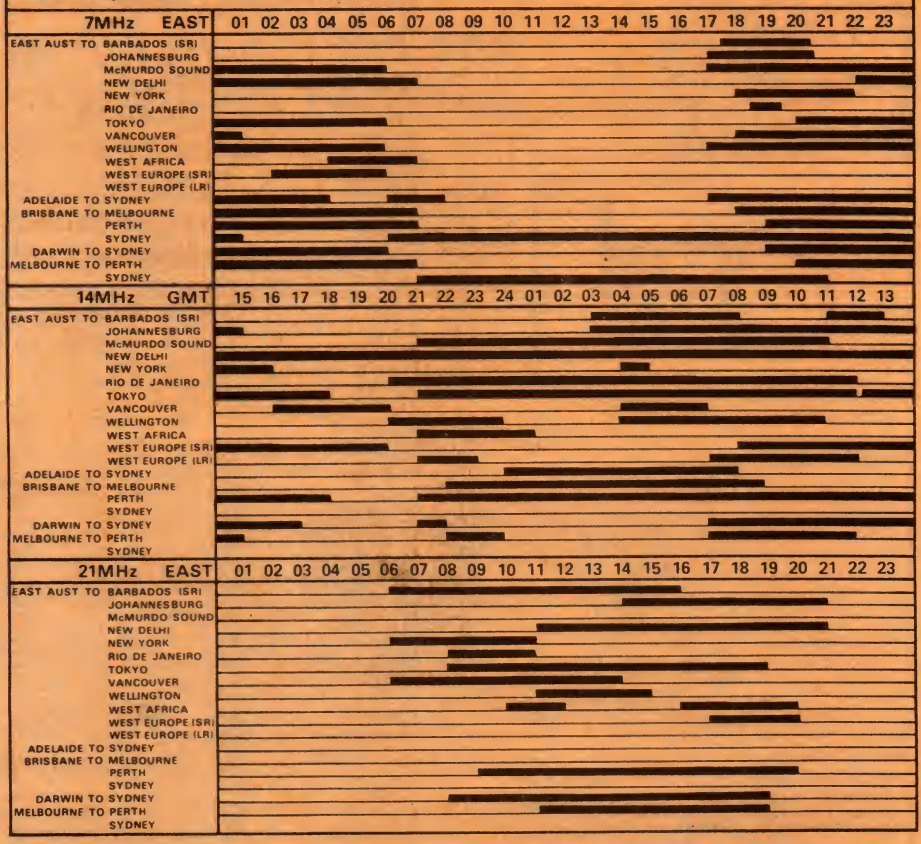
Club name: Redcliffe Radio Club.
Club call sign: VK4RC.
Meeting place: Redcliffe Education Centre, Henzell Street, Redcliffe.
Day and time: Mondays 7.30 to 9.30pm.
Affiliation: WIA Queensland Division.
Net frequency: 3648kHz (winter months), 14.3MHz and 28.55MHz.
Contact: Hon Secretary, PO Box 20, Woody Point, Qld 4019 or telephone (07) 284 6098.

Club name: Townsville Amateur Radio Club.
Club call sign: VK4WIT; repeater VK4RAT.
Meeting place: State Emergency Headquarters, Green Street, West End, Townsville.
Day and time: First Thursday in the month at 8.00pm.
Affiliation: WIA Queensland Division.
Net frequency: 3605kHz Sundays at 8.00pm, daily channel 2 FM repeater VK4RAT.
Contact: Secretary, TARC, PO Box 964 GPO, Townsville, Qld 4810.

Club name: WIA Central Queensland Branch.
Club call sign: VK4WIR, repeater VK4RAR.
Meeting place: Bolsover Chambers, opposite Technical College, Rockhampton.
Day and time: Third Friday of each month at 7.30pm.
Affiliation: WIA Queensland Division.
Net frequency: 144MHz channel 50 and repeater VK4RAR channel 2.
Contact: Lyle Dobbs, VK4ALD, 283 Elphinstone Street, North Rockhampton, Qld 4701.

IONOSPHERIC PREDICTIONS FOR MARCH

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 3.78



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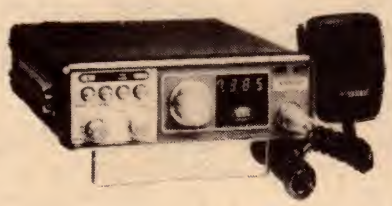

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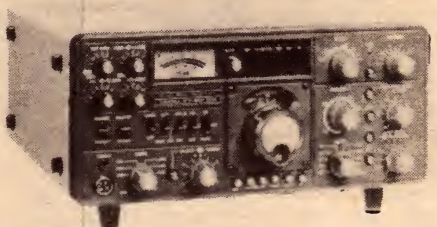

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YAESU MUSEN FT-227R 2-METRE TRANSCEIVER

Bail Electronics of Melbourne have submitted for our inspection a sample of the Yaesu Musen "FT-227R Memoriser" 2-metre transceiver. A very versatile unit, it is unlikely to be embarrassed by future band plan changes, repeater proliferation, or even a shift to another country!

The FT-227R is basically a 10W, 2-metre transceiver, using a PLL frequency selection system, and designed primarily as a mobile unit. Its versatility stems largely from its complete coverage of the 2-metre band; from 144MHz to 148MHz in 5kHz steps, or a total of 800 frequencies.

Some may regard this as an "overkill", in that we are currently using only the upper 2MHz of the band, with channels spaced at 50kHz. On the other hand, band plans can, and probably will, change. If, or when, they do this set should be able to cope with anything we can envisage for a long time to come.

In fact, such close spacing of the channels makes the set behave more like a continuously tunable one that a channelised one, but with the vital advantage of precise frequency control.

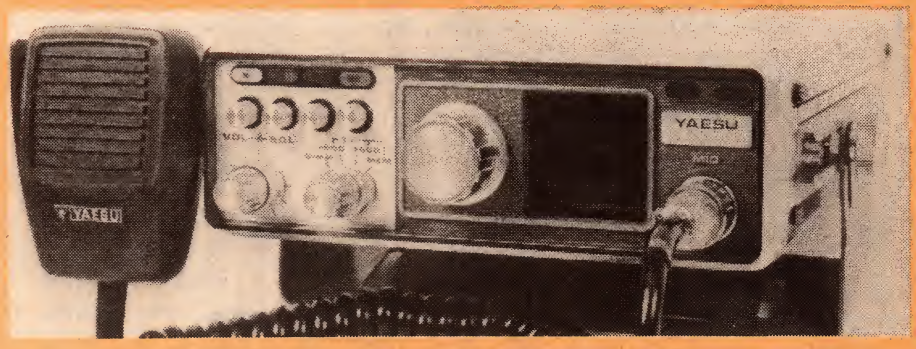
Frequencies are selected by a continuously rotatable front panel knob and presented on four digit LED display unit. The knob is not calibrated and, in fact, it's position bears no relationship to the selected frequency. When first energised the set selects 147MHz automatically, after which clockwise rotation increases the frequency up to 148MHz and anti-clockwise decreases it to 144MHz. It will not go beyond these limits.

This switch actually operates in 10kHz increments and a press button on the front panel provides a 5kHz up-shift for any selected frequency. The channel selector switch is also novel in that it has no mechanical contacts. It rotates a slotted disk between a pair of optical couplers and the pulses from these operate a counter, the output of which controls the phase locked loop. A major advantage of this system is high reliability, due to the complete absence of contacts.

Another attractive feature is a memory system. By simply pressing a memory button on the front panel the frequency in use is placed in store. The set can then be operated on any other frequencies and re-set to the original frequency at any time by pressing a memory recall button.

The memory system provides yet another contribution to the set's versatility. If you are travelling to another country where repeater offsets are other than 600kHz you have no worries. Simply feed the required transmit frequency into the memory, dial up the required transmit frequency, and select an appropriate position on the function switch.

And if this other country also requires a tone burst to access the repeaters, the FT-227R is equal to the task. It is fitted with a tone burst system set for 1800kHz for one second, but both frequency and duration are adjustable.



There is also available, as an optional extra, a tone guarded squelch system which allows all signals to be locked out by the squelch system unless they are accompanied by a tone of pre-arranged frequency, selected by the user.

The receiver is a double change superhet (10.7MHz and 455kHz), and the specifications claim a sensitivity of 0.3uV for 20dB quieting, and a selectivity of 6kHz at 6dB and 12kHz at 60dB.

The transmitter has a low power (1W) position, selected by a switch on the rear panel. The output stage is protected against high SWR and the specifications give spurious emissions as 60dB down.

Mechanically, the FT-227R is first class; very solid construction and very well finished. The mounting bracket for mobile use is truly universal. It may be used above or below the set and fits in a pair of runners which permit easy removal of the set for use elsewhere.

The instruction manual is also worthy of special comment. It is one of the best translations we have seen, as well as being most comprehensive. There is a large clear fold-out circuit, a complete parts list, and several coded photographs which must depict virtually every component in the system. And, while the makers recommend that any serious faults be referred to their agents, the manual contains instructions for alignment, output stage adjustment, PLL circuitry adjustment, and similar complex jobs.

As both a base and mobile station the set performed extremely well and we had no reason to query any of the specifications. All the reports we received commented favourably on the signal quality.

The only thing that worried us was the need to adopt a completely different operating procedure compared with sets using switch-selected pre-programmed channels. (Crystal or PLL controlled.) It is necessary to convert from thinking in terms of channel numbers to thinking in terms of frequencies. At the very least a channel-number to frequency conversion table is required, perhaps with repeater offset information.

One must also, in fairness, query the suitability of this form of channel selection for mobile operation; the use for which the set is specifically designed. To say the least, it is less convenient than pre-programed channel selection. On the other hand, the memory system gives a choice of 2 pre-selected channels at the touch of a button.

But these last points are minor ones — and not unique to this set. By any standards the FT-227R must be regarded as a first class piece of engineering, with many useful features, and which appears to do all the things the makers claim for it, and do them very well.

Further details, price etc, may be obtained from Bail Electronics Services, 60 Shannon St, Box Hill North, Victoria, 3129. (PGW)

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SHORTWAVE SCENE

by Arthur Cushen, MBE

Many countries broadcast to Australia & NZ

The increasing interest of short-wave broadcasters in Australia and New Zealand is demonstrated by the fact that nearly 40 countries now have transmissions beamed to this area. Together, these transmissions make up a combined 600 hours of broadcasting each week.

The short-wave broadcasting organizations in all continents now beam programs for reception in Australia and New Zealand. Increasing interest in this part of the world is being shown by many countries, in particular the newly-developing countries which have opened their own short-wave services.

In a recent survey of international broadcasting in an issue of the "Australian Radio DX News", it was found that there were nearly 40 countries with transmissions to this area. Of these transmissions, more than 400 hours a week were broadcast in English, and over 200 hours in foreign languages.

The transmissions were mainly for our evening reception, though broadcasts for morning and lunch hour listnening are also available on stations broadcasting from Europe and Asia. It is often difficult to define which transmissions are actually intended for reception in Australia or New Zealand, as some broadcasters list this area as the Pacific, others as Oceania, others as Australia and New Zealand. Then again, some use the term Australasia, while other stations call it the South Pacific.

The survey does not include stations which do not specify this area for reception, but there are many broadcasters who are providing secondary coverage to the South Pacific. Nevertheless, these figures show just how intense short-wave broadcasting is to this part of the world, despite the fact that they are of little propaganda value.

In the article in "Australian Radio DX News," writer Bob Padula refers to the fact that listeners have observed the dramatic escalation of interest in short-wave radio as a hobby in the past few years in the Asian region. This has been brought about by the increased availability of receiving equipment at a price that nearly everyone has been able to afford.

IRAQ EXPANDS SERVICE

Radio Iraq in Baghdad has recently added an English transmission to North America which is heard 0300-0400GMT on 11905kHz. The transmission suffers some light interference from 0320GMT when Rome Radio also opens on the frequency. The station is asking for reception reports to the English Section, Radio Baghdad, Baghdad, Iraq.

The broadcast to Europe has been noted at a new time. English is now transmitted 2130-2230GMT on 9745kHz. This transmission also includes German at 1930 and French at 2030GMT.

SPAIN'S EXTERNAL SERVICE

As the Spanish National Radio continues to expand its short-wave services, it is expected that frequencies will be used on a trial basis in an attempt to find clear channels.

Graham Daff of Cheltenham, Victoria, has provided a recent schedule which shows that the transmission in Spanish to Australia and the Philippines is broadcast 0800-1100GMT on 9520 and 11740kHz and 0930-1100GMT on 17735kHz. The transmission in English to North America, heard during our afternoons, is at 0100-0400GMT on 6065 and 11880kHz. The English service to Europe 2030-2130GMT and repeated 2130-2230GMT is broadcast on 6100, 7155 and 9505kHz.

The station is keen to receive reception reports and provides listeners with report cards or airmail forms on which to compile details of reception. The address, is The Spanish Nacional Radio, Madrid 24, Spain.

FREQUENCY EXPANSION

Radio Nederland, in a review of the upcoming 1979 Frequency Conference in Geneva, recently remarked that in the 20 years since the last conference short-wave transmissions have doubled in terms of broadcasting hours. This represents an increase of around 5% per year.

It is obvious that the short-wave bands are overcrowded. In fact, it would be necessary to double the size of the present short-wave frequency spectrum for international broadcasting to come back to the position it was in 1959.

There are already many countries who have put forward proposals to increase the size of the broadcasting bands. This, for the short-wave listener, would mean less interference and better reception of many stations, particularly the weaker stations. As far as broadcasting in Australia and New Zealand goes, it would mean a bigger choice of frequencies, less interference and a much more pleasurable listening to international short-wave stations.

TURKEY INCREASES OUTPUT

Ankara radio has increased its output on short-wave and introduced an additional program in English for South Asia and Australasia. The new broadcast in English is at 1200GMT on 9665kHz. The transmission is for one hour and at 1300GMT there is a broadcast in Urdu to 1330, Persian 1330-1400, and Arabic 1400-1500GMT.

According to the BBC Monitoring Service, the transmission to Europe in English has also been retimed and is broadcast on 7170 and 9515kHz at 2130-2255GMT, with a news bulletin at 2130 and a summary at 2230GMT. The Balkan Service is now transmitted 30 minutes later on 7270kHz from 1500-1700GMT. The Domestic Service still continues to be heard on 9515kHz, opening at 0400GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT.

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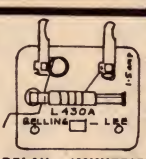

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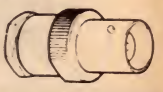

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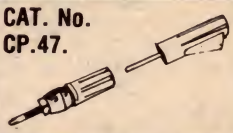

BELLING-LEE Miniature Terminal post with 2mm top socket and complete with stacking plug — in Blue, White, Green & Yellow. **50c per pair or 5 pairs for $2.25.**
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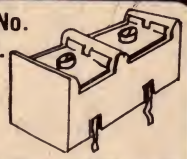

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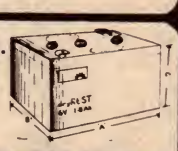

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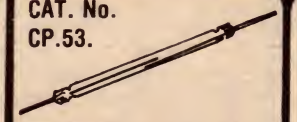

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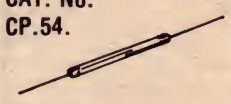

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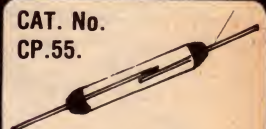

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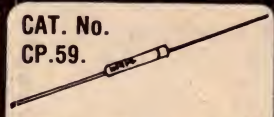

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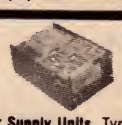

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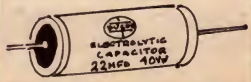

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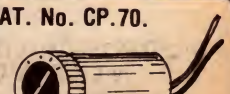

BATTERY INDICATOR LEVEL METER . . . Made by SONY. Size: 15mm x 10mm. **ONLY 75c each p & p 30c.**

SHORTWAVE SCENE

KTWR GUAM

Frequency changes are still being made by KTWR at Agana, Guam, as they expand their services with gospel programs to the Asian area. Two new frequencies are 11730 and 15195kHz, both heard at 1100GMT in English to 1130GMT when they broadcast in Cantonese.

Harvey Saward, Smithton, Tasmania, reporting in ADXN, notes interference on 15195kHz from Radio Japan. The latest schedule received from KTWR shows the English broadcasts as 0900-1000GMT on 15115kHz, 0915-0930 on 9640, 1000-1100 on 9640, 1430-1500 on 11730 and 15190, 0030-0100 on 17855 and 0100-0130 on 17855. Two transmitters of 100kW are used by Trans World Radio at Agana. Other programs are in Indonesian, Mandarin, Vietnamese, Lao, Cambodian, Japanese and Russian. As well as the short-wave facilities, KTWG operates on medium wave 770kHz with 10kW, and broadcasts 18 hours a day to Guam and the surrounding islands.

AUSTRALIAN EXPANSION

The up-grading of Radio Australia was announced some weeks ago and already new equipment has arrived at Shepparton in Victoria. This transmitting site has been in operation for some 35 years and the new equipment includes two transmitters of 100kW. As well, the station at Carnarvon now uses transmitters of 100 and 250kW. The tentative schedule for Radio Australia from March 5 shows the use of some new frequencies in its overseas service.

The transmissions of interest to readers include the broadcast to the Pacific. Changes for this area include the replacement of 9505 by 6045kHz 1530-2000GMT. As well, 9540kHz now broadcasts 0800-1500, while 15240kHz broadcasts 2030-0730GMT.

In the transmission to Papua New Guinea, a new frequency, 7240kHz, is used 1230-1730 and 1800-2100GMT. 9600kHz is now used 2000-2200 and 11790kHz 1000-1200, while 15335kHz is extended an hour and now operates 2330-0630GMT.

The service to Africa is on two new frequencies: 15260 and 21525kHz. The transmission time is 0400-0630GMT.

WINB SCHEDULE

The latest schedule from WINB Red Lion, Pennsylvania, gives their transmissions as 1700-2100GMT on 15340kHz, 2100-2300 on 11775, 2300-0000 on 15170, and 0000-0330 on 11710. The first two transmissions are beamed to Europe and the second two transmissions to South America, all over a 50kW transmitter.

The transmissions are mainly in English, but there are also programs in French, Greek, Russian, Spanish and Portuguese. The address of the station is World International Broadcasters, PO Box 88, Red Lion, PA 17356, USA.

LISTENING BRIEFS
EUROPE

PORTUGAL: The Voice of Hope has advised that, due to interference on 9670kHz from the Voice of America, the station is looking at the possibility of using 9585kHz for the period 0500-0700GMT. Douglas Doull of Auckland NZ reports that this frequency change could take place shortly. The transmission on Sundays is best received at 0930GMT in English when the frequency is relatively clear.

USSR: Radio KIEV in the Ukraine broadcasts in English 0300-0330GMT on 5905, 6020, 7215, 7360, 7400, 9470, 9580, 9635, 9665, 9800 and 12010kHz. 9800kHz provides the best reception. A service to Europe 1930-2000GMT is broadcast on 5970, 6020 and 7360kHz. A further broadcast to North Africa is scheduled 0030-0100GMT on 6020, 7150, 7215, 7400, 9800, 11690, 11790 and 15100kHz.

AFRICA

GUINEA: The Worldwide DX Club reports that a new station is under construction at Bata. Transmissions will be at 0530-0700 and 2130-0100GMT. The following frequencies have been registered: 3210, 7150, 7190, 9555, 9585, 11715, 11865, 15110 and 15190kHz.

ETHIOPIA: The Voice of Revolutionary Ethiopia now operates 1200-2000GMT, with English broadcast 1700-1800GMT. Two frequencies are used, according to the BBC Monitoring Service. These are 7165 and 9610KHz. The Domestic Service on 6185 and 7165kHz has been heard opening at 0400GMT, while close down is at 2100GMT.

GUINEA: Conakry is widely reported on 15310kHz and heard after 1900GMT when HCJB leaves the frequency. Bryan Clark of Wellington, reporting in the "NZ DX Times," states that the station has drum beats and full station announcement at 1901GMT, and has been heard past 2100GMT.

ASIA

SRI LANKA: The Deutsche Welle relay station, now under construction, will use two 250kW transmitters to beam programs to Asia and Oceania. This is the fifth relay station for Deutsche Welle and the first to be established in the Asian area.

INDONESIA: Indonesia's external service, "Voice of Indonesia," is now transmitted on 7110kHz instead of 9585kHz. The service continues to be broadcast on 11790kHz. Programs in English are on the air from 0100-0200, 0800-0900 and 1400-1500GMT beamed to South East Asia and the Pacific, according to a report in the BBC Monitoring Service.

GRADUATE TO AMATEUR RADIO

For many years the Wireless Institute of Australia, Victorian Division, has been conducting classes to obtain P & T Department Amateur Operators Certificates (full, limited, and novice).
Our next AOCP class commences on Monday, 20th March with Theory 7.30 to 9.30 Monday evening and Morse 7.30 to 8.30 Tuesday evening. Our next novice course will commence following the next novice exam. The novice classes are from 6.30 to 9.30 Tuesday evening.
If you are interested in these classes please ring the Institute Tuesday, Wednesday, Thursday, Saturday morning, or Monday evening or attend the first class.

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Books & Literature

RSGB handbook . . .

RADIO COMMUNICATION HANDBOOK. Fifth edition, volume 2 (of two volumes). Published by the Radio Society of Great Britain. Stiff covers. 322 pages, 247mm x 180mm, copiously illustrated with diagrams and photographs. Price in Australia, $20.00.

Volume 1 of this handbook was reviewed in the July 1977 issue of "Electronics Australia" and the general level and philosophy of the publication was covered in that review. There would seem to be little point in repeating this background and we refer any interested readers to the July issue.

Volume 2 contains chapters 11 to 23, with the following headings. Chapter 11: Propagation, 12: HF Aerials, 13: VHF and UHF Aerials, 14: Mobile and Portable Equipment, 15: Noise, 16: Power Supplies, 17: Interference, 18: Measurements, 19: Operating Technique and Station Layout, 20: Amateur Satellite Communication, 21: Image Communication, 22: The RSGB and the Radio Amateur, 23: General Data.

While it is not possible to review all the chapters in the space available, one that stands out for comment is chapter 12 dealing with HF Aerials. It occupies 98 pages — nearly one third of the book — and ranges from fundamental principles, wave motion etc, to typical aerial designs, impedance matching, right through to the mechanics of aerial and mast construction.

Mention should also be made of the chapter on interference, ie, interference with domestic radio and TV receivers. This appears to be most comprehensive and, in view of the sensitive nature of this problem at the present time, it behoves all amateurs to have as much practical information at their disposal as possible. This chapter must be a valuable addition to any amateur's references on the subject.

Summing up: The high standard evident in volume 1 is fully maintained in volume 2 and, together, they contain a welath of information for the serious amateur. Highly recommended.

Our copy from Technical Book and Magazine Co Pty Ltd, 289 Swanston St, Melbourne, Victoria. (P.G.W.)

. . . and reference book

RADIO DATA REFERENCE BOOK. Fourth Edition, by T.G. Giles and G. R. Jessop. Published by the Radio Society of Great Britain, 1977. Hard covers, 192 pages, 230 x 150mm.

Despite the fact that this book has been compiled by two British amateur operators and published by the RSGB, it is not in any sense a handbook peculiar to the needs of amateurs. In fact, it is the kind of volume any electronics engineer or technician would welcome on his bookshelf, because of the amount of data it contains.

Originally published in 1962, the book has since been completely updated, with new information added about semiconductors, heatsinks and filters, in particular.

Sections include: Preface — Units and symbols — Basic calculations — Resonant circuits and filters — Circuit design — Aerials and transmission lines — Radio and TV services — Maps and meteorological data — Materials and engineering data — Mathematical

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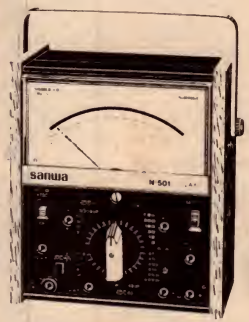

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tables and index.

Emphasising my earlier remark about not being peculiar to the needs of amateurs, there is a lot of data bout SI units, materials and engineering, and such things as television frequencies and standards around the world. In all, a handy book, submitted for review direct from the publishers. For supply, watch the local booksellers' adverts. (W.N.W.)

. . . and call book

RSGB AMATEUR RADIO CALL BOOK 1977 edition. Published by the Radio Society of Great Britain. Stiff paper cover, 176 pages, 240mm x 180mm. Price in Australia $5.90.

As the title suggests, this is basically a list of all the licensed amateur stations in Britain, including Scotland, Wales, Northern Ireland, the Republic of Ireland and the various off-shore islands. There is a small amount of supplementary information such as amateur international prefixes, ITU zones, etc., but primarily it lists amateur call signs in alphabetical order, together with names and addresses. Compared with the last edition, about 2000 names have been added and about the same number deleted.

If you're an amateur given to working DX, the purchase price of the book won't bother you. Our copy came from the Technical Book Company, 295 Swanston St, Melbourne. (W.N.W.)

Limited interest

THE LOW AND MEDIUM FREQUENCY SCRAP BOOK by Ken Cornell, W21MB. Third edition, published 1977 by Communications Technology Inc. Stiff paper covers, 110 pages 280mm x 220mm, stapled. Australian price $9.85.

Ken Cornell has been an amateur and experimenter for 40 years or so and would appear never to be happier than when fiddling with low-power low-frequency home-made receivers and transmitters. To scan his notes, out of which this virtual loose-leaf, duplicated-style book has grown, is to take an almost nostalgic trip through a forgotten world of basket weave coils, valves, frame antennas and so on.

However, it is a world which has no legal relevance in this country. A call to the local Radio Branch confirmed my impression that there is no provision in the Australian regulations for experimenters to operate low-power "intelligence" transmitting equipment without a licence on frequencies between 10-490kHz, and 510-1600kHz.

So buy the book if you want to but ignore the pages of American FCC regulations and forget any ideas you may have about playing around with low-powered transmitters without a licence. Our copy came from the Technical Book Company, 295 Swanston St, Melbourne. (W.N.W.)

BOOKS

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6 x 4, 33 ohm	$4.00
6 x 9, 27 ohm	$7.00
6 x 9, 47 ohm	$7.00
6 inch Dual Cone, 27 ohm	$5.00
6 x 4, 4 ohm	$3.50

ELECTROS
2000 MFD 25 V. **50c**

PHILIPS 110 DEG YOKES $10

POTS

½ Meg switch **50 cents**

10K switch 50 cents. 1 Meg **50 cents.** ½ Meg **50 cents.** 100K switch **50 cents.** 250K **50 cents.** 7500K **50 cents.** 25K **50 cents.** Dual concentric 500K 1 Meg **$1.** Dual concentric 50K 25K **$1.** 1 Meg Dual ganged log **$1.** ½ Meg dual ganged double pole switch **$1.** 2 Meg dual ganged Lin **$1.** 1 Meg dual concentric **$1.** 500K min **4 for $1.** 10K min **4 for $1.**

SPECIAL
25 mixed transistors and diodes **$2**

SUPER SPECIAL OUTPUT TRANSISTORS
AD 161
162 K5 **$2.50 A PAIR**

SLIDE SWITCHES
4 mixed types **4 for $1**

SLIDE POTS 250K **4 for $1**
1 Meg **4 for $1**

MICROPHONES
plug and lead **$2.50**
DYNAMIC

GRAMOPHONE MOTOR
and Turntable 3 speed **$3**

5 Position Switch Printed Circuit Board
5 Diode, 3 Transistors, etc. **$2**

POWER DIODES
0A636 1000 v 50 cents

VU METER $3.00 pair

Super Special BSR 4 speed Gramophone motor and pickup, 240 volt with separate power supply for amplifier, etc.
22 volt DC
15 volt AC
$7.95

CONVERGENCE BOARDS
for Colour T.V. Complete **$4**

PICK UP ARM
balanced complete with ceramic cartridge **$9**

SPEAKER CABINET including 2 dual cone speakers, 6½ inch 10watts RMS **$16.** Size 16½ x 10¼ x 8. Pack & post Interstate **$5** a pair, NSW **$3.00.**

Super Special Record Player $12

B.S.R.

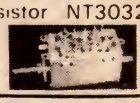
BASES FOR RECORD PLAYERS
Size 18 x 14¼, 3¾ **$5.00**
Pack & Post $2.50, Interstate $3.50.

FERGUSON SPEAKER TRANSFORMERS
OP 112 7-64 $15
PP $1.50, Interstate $2.50.

SPEAKER SPECIAL 2¼ INCH 8/Ohm 2 for $1.

SPEAKER AND CABINET
Size 10 x 7¼ x 4 **$4.50**
incl 6 x 4 speaker

PHILIPS TV TUNERS
Transistor NT3032 **$10**



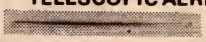
POWER TRANSFORMER
300 mil 240 volt; 115; 110; 6.3 **$5**

VALVES
6 BL 8 6 cwt
$1.00 each

FERRIS CAR RADIO VALVE TYPE
12 volt S.H. **$10.00**

POWER LEADS
ETC.
for tape recorders, etc. **75 cents**

TELESCOPIC AERIALS



$1.50

3 position push button switch 50 cents

POWER TRANSFORMER
240 volt, 180 volt, 6.3.V 40/mil
$2.50

BARGAINS BARGAINS BARGAINS BARGAINS

Hook up wire 30 mixed colours $1
250 mixed screws with self tappers, bolts, nuts, etc. $1.25 + postage 50c.
100 mixed radio TV knobs including fine tune & channel change $5.00
½ meg. double pole switch pots 50c.
Mixed pots 30 including ganged & concentric $5.
Morganite & IRC 33 useful valves fresh stock $2.00 + postage 50c.
Slide switch 3 position 50 cents.
50 ohm Pots ideal for ext. Speakers 50 cents. Transistor and Driver Speaker Transformers $1.00 pair. Ferrite Rods 6½ × ½ inch 50 cents.
Pots 30 mixed values including ganged and concentric $5.
In Line Fuse Holders 20 cents Stereo Speaker Wire 12 cents yard.
100 Mixed TV and Radio Knobs including Fine Tune and Channel Change $5.
Slide Pots 250 K 4 for $1.

Car radio suppressor condenser 30 cents.
boost controls. Includes fancy chrome face plate $10.
Electros 3 in one 100-25-40, 24-250-300. 50-250-300 75 cents.
Screw in 6 Volt Pilot Lights $1.50 for 10. Plug-in type 10 for $1.00.
3.5 to 3.5 Jack Plugs 7ft Shielded Cable 75 cents; 6.5 to 3.5 Jack Plugs 7ft. Shielded Cable 75 cents.
Mixed Tag Strips 50 cents for Dozen.
Special Fancy chrome knobs. Ideal for amplifiers, 5 for $1.
Tape Recorder Heads Transistor—Top quality suit most recorders $5.00.
Jack Plug Sockets 6.5 mm 35 cents.
Morganite and IRC resistors 33 values $2 per 100 pack and post 45c.
Philips Gramo Motor and Pickup 4 Speed 6 Volt $7.75.
Crossover Condensers 2 mfd 60 cents.

Microphone Transformers 50 cents.
Switch Wafers: 11 position 20 cents.
Perspex tops for record players size 12×8½×3¾ $1.50.
Pots: 50k 50 cents; 1M 50 cents.
Double Pole Switch Pots 50 cents.
Coaxial TV Feeder Cable 75 ohm 30 cents yard.
Jack Plugs 6.5 mm 50 cents; 3.5 mm 25 cents. R.C.A. Plugs 25 cents.
Hook Up Wire 30 mixed colours lengths $1 bag.
Speaker 4 pin plugs 15 cents. 25 mixed and 5 and 10 Watt resistors $2.00.
250 mixed screws, BSA, Whit self-tapper bolts, nuts, etc. $1.25 bag plus 40c post.
TV Aerials Complete Range Hills Color $12 to $60.
Car radio aerials, lockdown, top quality extended 1600 mm $4.50.
Electros 3-in-one: 20, 400, 450; 10, 400, 450, 75, 50, 65 $1.00
Power Transformer 60 mil 240 volt 36 volt. Centre tap 6.3 winding $5.
Mics Dynamic 10k $3.50
Valve Sockets: 7 or 9 pin 10 cents. Octal 10 cents.
6.3 winding $5 small power transformer 240v, 220v and 22v windings $3.
Pilot Lights. 24 volt screw-in, 10 for $1.50
Ferrite Rods 6 inch 50, 9×½ 75 cents.
Pots: 10K ganged log 50 cents; 1 Meg ganged log $1.25; ½ Meg ganged log $1.25; 2 Meg ganged log $1.25;
2 Meg double pole switch $1.50.
Sharp TV Flyback Transformers 8 FT 604 $7.00.
Miniature Speaker Transformers, drive and output $1.00 pair.
Heat Sinks: 4×2 1¾ $1.50.
Speaker Transformers 7000 to 15 ohm $1.75.

SPEAKERS SPEAKERS SPEAKERS

6½ Inch Dual Cone 4 ohm	$5.00	6 inch Dual Cone Tweeters	$6.00	MSP 4 x 2 5 ohm	$2.50
4 x 2 8 ohm	$1.50	5 inch Magnavox Dual or 8 inch 27 ohm	$6.00	MSP 6 x 4 4 7 ohm	$3.50
8 TACX 8 ohm	$8.00	Magnavox midrange 5 inch dual cone	$8.00	ROLA 6 x 9 4 7 ohm	$6.00
6 x 9 in 8 or 15 ohm	$6.00	MSP 5 x 7 inch 3½ ohm	$4.00	Magnavox 5 inch 8 ohm	$4.00
5 x 7 in 8 or 15 ohm	$5.00	Magnavox 5 inch 15 ohm	$4.00	Magnavox 6 x 9 inch 3½ ohm	$5.00
6½ inch 8 or 15 ohm	$4.50	MSP 2¾ inch 8 ohm	$2.00	Magnavox 5 inch mid range 8 ohm	$6.00
8 x 4 8 or 15 ohm	$4.50	Magnavox 5 inch 15 ohm	$4.00	Magnavox 10 inch dual cone 15 ohm	$10.00
6 x 4 8 or 15 ohm	$3.50	Magnavox 6 inch 3½ ohm	$5.00	MSP 4 or 5 inch 3½ ohm	$3.50
5 x 4 15 ohm	$2.50	Magnavox 5 x 3 8 ohm	$2.50	2¾ inch 33 ohm	$2.00
4 inch 8 ohm	$2.75	Magnavox 4 ohm 5 x 3	$2.50	5 x 4 3 5 ohm	$3.50

New Products

Semiconductor curve tracer expands 'scope use

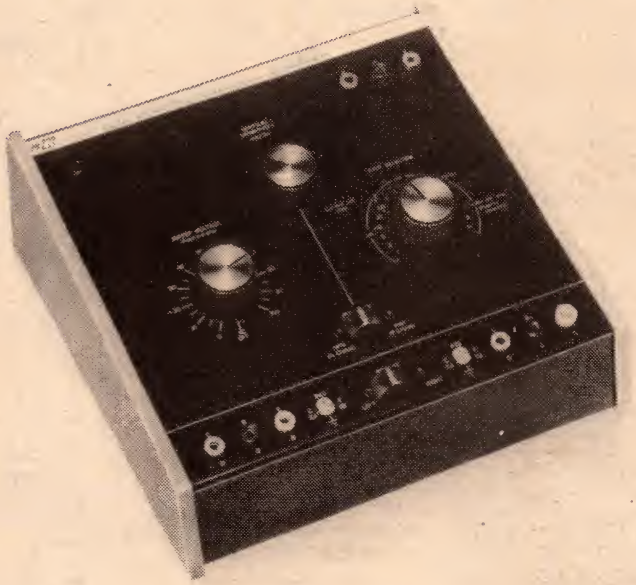
The B&K Model 501A Curve Tracer allows the characteristic curves of semiconductors to be displayed on any oscilloscope having an external horizontal input.

Among its many capabilities, the tracer displays AC and DC beta; diode dynamic resistance; SCR, diac and triac characteristics; and mosfet and tunnel diode characteristics. Collector sweeps to 100V DC peak and 100mA maximum in both NPN and PNP configurations are possible, with current limiting on each of the 11 ranges.

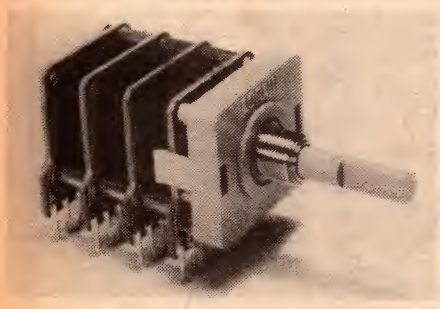
Six steps are shown on the continuous display. The step generator increments in 11 current ranges up to 50uA, and on five voltage ranges from 0.05 to 1V. Calibration is within three per cent.

Devices may be plugged directly into the unit. Alternatively, a special probe with three spring-loaded adjustable tips may be used to check devices in circuit. A lead is also included for connection to the oscilloscope.

For further information on the B&K Model 501A Curve Tracer, contact Parameters Pty Ltd, 68 Alexander St, Crows Nest, NSW 2065. Telephone 439 3288.



PC mounting switch



Now available from the Lorlin range of rotaries is this multi-bank switch designed for mounting on a PC board.

Designated type P.T., the new switch offers 30° indexing, up to 12 positions, and an adjustable stop. A brass mounting bush and plastic shaft are standard.

Enquiries to C&K Electronics (Aust.) Pty Ltd, PO Box 101, Merrylands 2160.

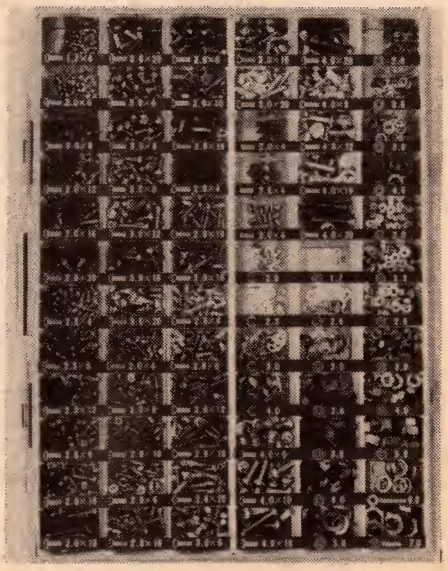
Replacement nuts, bolts & washers

Designed mainly for the laboratory and for service work, this handy kit contains a complete assortment of ISO standard screws, nuts and washers as commonly used in Japanese electronic products.

The kit contains 2820 pieces, and includes the following: round head screws, countersunk head screws, round head self tappers, grub screws (for knobs, etc), nuts and washers of various sizes and circlips (eg for turntables and tape recorders).

Cost of the kit is $69.00. This is good value for money, especially when you consider that it represents a cost of less than 2.5 cents per piece, and that there are some 72 different piece types. Add to that the attractive presentation box and you have a service kit that no workshop should be without.

We have only one reservation — what if the box was dropped? Quite an unpleasant thought, that!



Enquiries to Dick Smith Electronics stores in Sydney, Melbourne, Brisbane and Adelaide.

ZOOM FOCUSING MICROSCOPES 900X

$23.95
Battery
and
Mirror
illuminated
Zoom
1200X
Similar To Above
$35.00

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$35.00
(2 TELEPHONE SETS)

$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

FOUR CHANNEL VHF TRANSCEIVER

125 to 140 M/hz. 28 volt DC operated AM single crystal locks both TX and RX on same channel complete with generator.

$33.00

EX ABC MAGNETIC RECORDING TAPES ¼"

PROFESSIONAL QUALITY

5" x 600' $1.50
7" x 1200' $2.75

P&P A. $1.10, B. $2.00, C. $2.25, D. $2.25

COLLINS INDEPENDENT SIDEBAND TRANSCEIVER TRC/75

Fully synthesised transceiver with am, upper, lower and independent sideband operation. 1KHz steps from 2MHz to 29.999MHz 1 microvolt sensitivity, 2.5KHz bandwidth ssb, 6KHz bandwidth AM. 1 RW. PEP max ouput. Fully automatic tuning of both transmitter and receiver from remote control unit. Complete with automatic aerial coupling unit, mic, headset, etc. 400Hz supply.

Ideal for amateur use.

PRICE $750

No. 62 TRANSCEIVER

With headphones accessories etc

$60

TELEPHONE WIRE

1 mile twin (2 miles) genuine ex-Army Don 8 perfect condition $35 per drum $2.00 cartage to rail freight payable at destination.

RCA 77DX MICROPHONES

PROFESSIONAL QUALITY $75
P & P A. $1.80 B. $3.50 C. $4.55
D. $4.55.

MORSE KEY $1.75 Post 40c | **MORSE KEY BUZZER! $4.25** Post 60c

KAISE MULTIMETERS

A compact and handy tester for workshop or lab where quick circuit checks are required

DC Volts 2.5 to 1.000V (20.000 OHMS per volt) AC Volts 10 to 1.000V (10,000 OHMS per volt) DC Current 50 UA 25 MA 250 MA. Resistance 40 K OHM, 4 MEG OHM Decibels minus 20 DB plus 62 DB complete with instructions only **$23.95** Ea. P.P. $1.05. Multimeter similar to above 30,000 OHMS per volt **$29.50** P.P. $1.05.

Only $17.25 ea Post $1.05

SIEMENS Typing Perforator

240 Volt Type with Keyboard **$57.50**

4 DIGIT RELAY COUNTERS

50 volt DC, suit slot car Lap counters, etc.

$1.25 each P & P 60c

SENSITIVE ALTEMETERS

Ex RAAF Smiths, **$65** each p&p $1.10.

NIFE CELLS

1.2 Volt, fully charged, 4in x 3in x 1in 4 AH.

$1.50 each P & P 80c

5" CRO TUBE 5 BPI $5.50 each

Post A $1.40. B $2.25. C $2.70, D $3.45

HANDY SIGNAL INJECTOR

Produces an Audio Signal in rich harmonics. Ideal for Sig Tracing in A.F., I.F., and R.F. circuits. Powered by 4 Penlight Batteries with On Off Switch and indicator lamp. Size 1½" Diam. 5" Long. Only

$6.95 Post $1.10

POSTAGE KEY:

A: NSW.
B: Vic, Qld, SA
C: NT, Tas.
D: WA.

VALVES

BRAND NEW			
6BM8	$1.80		
6GV8	$1.50		
65N7GT	95c	CV850	$1.50
5U4G	95c	1H6G	75c
EF50	75c	832	$5.00
5Y3	$2.25	6X4	$1.80
2 x 2	75c	VR65	75c

P & P 40c

ARTILLERY DIAL SIGHTS MK2

Can also be adapted as a Dumpy Level or as base for a telescope has full 360° 5½" diam. gunmetal rotating circle. Adjustable elevation and depression. Has top grade ¾" diam. object lens. F.L.10" with cross hairs, eyepiece, ½" right angle prism.—height 10"—weight 3½kgs. With leather carrying case. Original cost $300.
Our Special only **$27.50**
P&P A. $1.95, B. $4.25, C. $5.90, D. $5.90

ZOOM SPOTTING SCOPES

30 x 30
LENGTH 12½", HEIGHT 10"
WEIGHT 1¾ lb.
$27.50

60x60
Length: 22in
Height: 18in
Weight: 2kg
$67.50

High grade coated lenses. Ideal for pistol and rifle ranges or general viewing. Zooms in from very low to high powers. Complete with tripods.

POST: A. $1.70, B. $2.25, C. $2.40, D. $2.65.

TELESCOPES

25 x 30 **$7.95**
P & P A. $1.70, B. $2.25.
C. $2.40 D. $2.65.

SPY TELESCOPES

8 x 17 mag size of a rifle cartridge extends to 8" Only **$5.95** each. post 60c

BINOCULARS

PRISMATIC Coated Lenses. Brand new. Complete with case.

		P&P	
8 x 30	$32.50	A	$1.65
7 x 50	$43.95	B	$2.75
10 x 50	$44.95	C	$3.20
12 x 50	$46.00	D	$3.20
20 x 50	$47.50		

SMALL CLIP-ON POCKET TELESCOPE

15X **$5.20** Post 60c

RECEIVER No. 210

2-16 M/cs **$65.**
Transmitter No 11 suits 210 **$35.**
24 volt Power supply to suit above **$15.**
Or complete station with Headphones. Mic Morse Key. Antenna **$110.**

SOLENOIDS

Plunger Type 24V 300MA. Suit electric camera control, miniature trains, radio. etc.

$2.50 P & P 20c
200 MA 24 volt, ½in push movement. $2.50 P & P 20c.

SELSYN MOTORS MAGSLIP

RECEIVERS 2" MK2 $5.50
TRANSMITTER 3" MK2 $15.00

Post Packing A. $1.75 B. $2.75 C. $2.75 D. $3.65

3000 TYPE RELAYS

P.M.G 200Ohms — 1'500Ohm
Coils **$2.50** each P & P 60c

P.M.G. TYPE KEY SWITCHES. 75c P & P 20c

CONDENSER LENS

1½" Diam 4½" F L **75c** 2½" Diam 2" F L **$1.50** each Or **$2.50** per pair P & P 40c

IMPELLER PUMPS

New gunmetal body, Stainless Steel Shaft. Neoprene Impeller Up to 15ft. Lift, suitable for almost any type of liquid. Self priming. Ideal boat bilge pump, sullage drains, etc. Approx size 8" x 5"

⅜" **$25.95** ½" **$34.95** ¾" **$39.95**

P & P A $1.90. B $2.75 C $3.20. D $3.95

MEGGER Battery Operated

No cranking—in vinyl case. Ranges: Meg Ohm 0-1000 Megs. Centre 20 meg. Rated voltage 500 volts. Low ohm 0-1000 ohm OH 1 range 0-1 meg ohm on 1k range. AC voltage 0-250 volts. **$85.00**

Post A. $1.60. B. $2.50. C. $2.75. D. $2.75.

Whip Antennas

8ft in 6 tapered sections, copper plated steel no base **$9.50.**

Post **$1.10**

COLLINS SYNTHESISED 1 SB RECEIVER

TRC/75 receiver section of transceiver specification as above.
PRICE $400

MAGNESIUM DRY CELL BATTERIES

Suits PRC 25 and dozens of other uses. 15 volts long life only **$1.50 ea.**

P & P A. $1.65 B. $2.75 C. $3.20 D. $3.20.

AIRCRAFT INSTRUMENTS

Directional Gyros.
AN5735-1 Air Operated.
Dimensions: 6inx5inx5in.
Weight: 2kgs
$35

Sperry Artificial Horizon.
AN5736-1 Air Operated.
Dimensions: Length 9in;
Diam. 4½in.
$45.

Slip and Turn Indicators
Electric. Type Mk. 12.
24Vdc.
Dimensions: Length 6½in.
Diam: 3¼in.
Weight: 1kg.
$17.50.
P&P. A $1.60. B $2.50. C $2.75. D $2.75.

TRANSCEIVERS Ex Army

No C42 set. 36 to 60 MHz with 24V power supply, headphone, mic, leads etc **$65.00**

No C45 set 23 to 38 MHz with headphones, mic. 24V power supply etc. **$95.00**

$1.00 cartage to rail, freight payable at nearest railway station

EX-ARMY TWO-WAY FM RADIOS

1.2 WATTS OUTPUT
SUPERHET
PRC9 AND 9A 27 to 39 M/HZ
PRC10 AND 10A 38 to 55 M/HZ
WITH HANDSET ANTENNA $25 EA
Battery $3.50 extra. Harness $4.50 extra
$2 Cartage to Rail. Freight payable at nearest attended Railway Station.

16MM SOUND PROJECTORS IN GOOD WORKING ORDER

240 volts operated Complete with Speaker and Amplifier.

RCA **$275**

$1 Cartage to Rail. Freight payable at nearest attended Railway Station.

CB RADIOS

PMG Approved. Famous Pony Brand on 27 Meg.
7 transister model **$55** per set of two (hand held).
11 transistor model 1watt (hand held) **$72 ea.**
5 watt 6 channel **$99 ea.**
Post A. $1.65. B. $2.75 C. $3.20. D. $3.20.

COMMUNICATIONS RECEIVER

COLLINS R — 391/URR

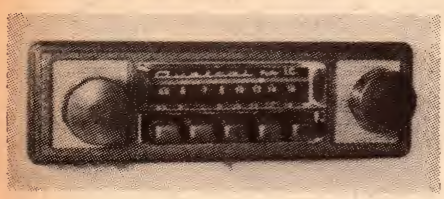
Continuous tuning of range 500 Kills — 32MHz in 32 bands. Receive frequency indicated directly on digital counter type readout to within 300Hz. Selectivity adjustable in six steps. From 100Hz to 16KHz bandwidth using mechanical filters. Sensitivity 1 microvolt or better 240 VAC operation — 10 inch rack mount — autotone on eight preset channels available complete with instructions and service manual and tested. **PRICE $500**

Deitch Bros.

70 OXFORD STREET, SYDNEY 2010

SORRY NO C.O.D

IC car radio



Toma Television Services of Sydney has recently extended its business to include manufacture and distribution of the Austral car radio.

The Austral is designed around a single IC developed by AWA especially for car radios and is claimed to be the first of its kind in Australia. Specifications include better than 1uV sensitivity and AGC action from 1V down to 1uV. Retail price is $59.00.

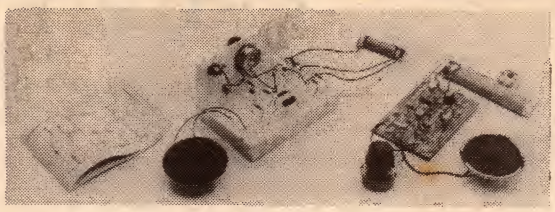
Enquiries to Toma Television Services, 156 Sydney Rd, Fairlight 2094. Telephone 948 8372.

FUNDAMENTALS OF SOLID STATE

It's for anyone who wants to know just a little bit more about the operation of semiconductor devices.

$3.00 plus 60c p & p Electronics Australia, Box 163, Beaconsfield, NSW 2014.

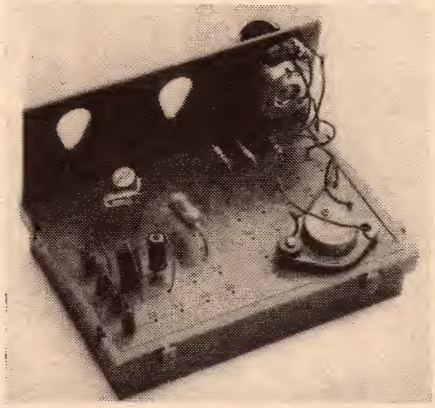
DeC-IT and BLOB-IT



Each circuit diagram has the holes numbered into which the components are inserted.

Push the component into the S-DeC. No soldering.

Plug components in and out. When circuit is proved working, transfer component by component to exactly same numbered position in Blob-Board.



S-De-C is designed for the use of discrete components and is particularly useful for basic educational purposes.
(No. of contacts 70)
Price per deck $7.84
Blob board ZB5D is an exact match to the S-De-C bread board.
Price for pkt of 3 boards $2.34

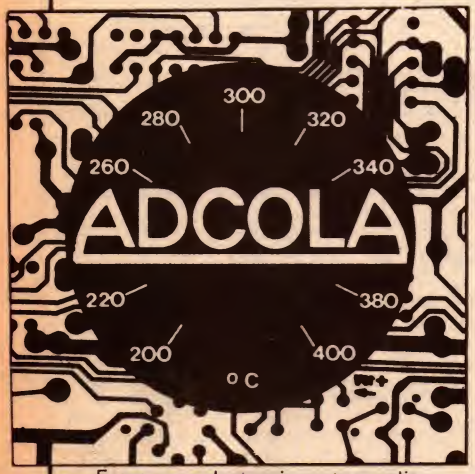
AVAILABLE AT ALL GOOD COMPONENT STOCKISTS

Distributed by

BLOB BOARD ASSOCIATES

PO BOX 23
SURREY HILLS, VIC. 3127
or ring (03) 89-1019

Controlled temperature soldering.



From your electronic parts supplier or enquire from

ADCOLA PRODUCTS

Melbourne 848 3777 — Sydney 709 5293
Brisbane 44 0131 — Adelaide 42 6655
Hobart 34 2233 — Launceston 31 2511
B77A — Perth 381 5500

For advanced work on critical or sensitive circuits.

Line Voltage

THERMATIC SOLDERING TOOL

Electronic feedback temperature control. All solid state sensing and switching contained within the slim handle. Screwdriver temperature selection, close temperature control.

Low Voltage

ECT SOLDERING STATIONS

Electronic feedback temperature control. Zero voltage switching to avoid damage to sensitive solid state components. Temperature is controlled within a narrow band. Selector dial on cabinet.

FULL DESCRIPTIVE LITERATURE AVAILABLE

Letters to the editor

Loudspeakers

This letter is to inform you that a new line of speakers is now manufactured by myself to order. There are three sizes, all fitted with Australian made woofers, tweeters and crossovers.

The mini is 386mm wide x 554mm high and 226mm deep with a 200mm woofer and 25mm tweeter. Rated at 15Watts RMS, it costs $157.90 a pair.

The midi is 350mm wide x 790mm high and 300mm deep with a 300mm woofer and a 50mm tweeter. Rated at 18 Watts RMS, it costs $163.34 a pair.

The maxi is 628mm wide x 790mm high and 400mm deep with a 300mm woofer and a horn tweeter. Rated at 20 Watts RMS, it costs $251.44 a pair.

All are available in right hand and left hand configuration. All are eight ohm with fixed frontal material and a screwed block connection at rear. The maxi and midi have legs but not the mini.

Finishes can be chosen at a demonstration at my workshop. Vinyl is included in the above prices.

All take five days per pair to make in my small workshop, and the above prices include $30.00 labour per pair as I am not out to make money but to supply good sound speaker systems.

I hope you are able to publish this information.

G. R. Druery.
36 Palmer Street,
Nambucca Heads, 2448.

Goggleless welding?

I am rather disturbed to note your comment in the January article on Yull Brown that "Also you apparently don't need special goggles, because there is no ultra-violet light produced," while talking about oxygen-hydrogen welding on page 14, column 3.

This comment is, I feel, both misleading and dangerous as special goggles should be worn for all flame welding processes, not only to shield the eye from the luminosity of the flame itself, but also to protect the welder from eye damage which results when looking at the very bright weld pool of molten metal with the naked eye. It is an unfortunate statistic that more eye damage occurs from operators using gas welding and cutting equipment without goggles than from the ultra-violet light produced in arc welding. The reason is simply that the latter is so bright everyone recognises the need for eye protection whilst the former, while bright enough to cause retinal spot damage, seems harmless when observed with the naked eye.

R. G. Hodgkinson
Manager, Messer Griesham Section
(Welding and Cutting)
Hoechst Australia Ltd.

Door opener

Thank you for the review of the Moore-O-Matic automatic door operator in the October 1977 edition of Electronics Australia. Your readers have responded to the article favourably, and we have received many requests for further information.

The points have arisen, namely the automatic reverse feature and the problem of entering the garage in the

LEADER TEST INSTRUMENTS

NEW
LBO-507
5" TRIGGERED
OSCILLOSCOPE

NEW
LBO-508 DUAL TRACE
5" TRIGGERED
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NEW
LBO-520 DUAL TRACE
5" TRIGGERED
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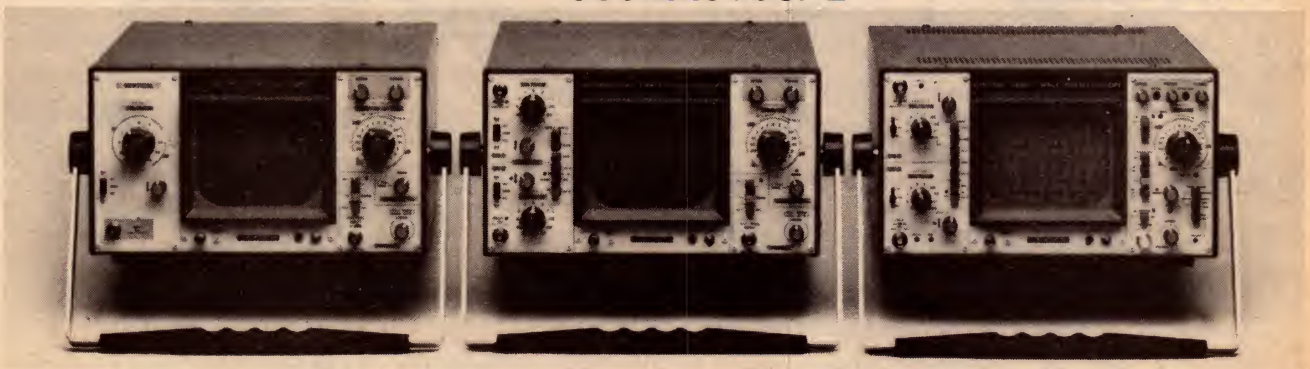

LBO-507 and LBO-508 include the required functions for accurate display of all types of waveforms. The Oscilloscopes are particularly suited for use in servicing television receivers, VTRs, computers, and other electronic equipment. The wideband and high sensitivity characteristics, 20MHz/10mV, and other latest features, make these Oscilloscopes most desirable for use in service shops, technical schools, laboratories, etc.

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WF 530/77

event of a power failure, where there is no side entrance.

Firstly we have explained that the open — close force adjustment is very sensitive and no damage is likely to occur to the door of the obstructing object.

On the second point, there is an accessory available in the form of a lock and key with a turn and pull out cylinder attached to the door arm rope, for use in case of power failure.

Ray Volpatti, Manager
Raydoor
Fivedock, NSW.

Thermometer project

I have two comments on the article "An electronic dual thermometer" by Ian Pogson, in the January, 1978, edition of "Electronics Australia".

1. The humidity table on page 38 is for ventilated thermometers, and presumably there was no intention for users of your circuit to ventilate the diode probes. The wet bulb "depression" obtained with non-ventilated thermometers will be less than for ventilated thermometer, with the result that the humidity will be overestimated. At high humidities the error is small e.g. 1% error at 80% humidity, 24° dry bulb, but at lower humidities as found inland the error is larger (e.g. 3-4% at 30% humidity and 24° dry bulb).

G. S. Shell M.Sc.
Chartered Electronics Engineer
Yenda, NSW.

INTERCOM . . .
from page 50

sure the board is not distorted by being pressed against the case. A simple clamp was made up to hold the battery, as seen in the photograph.

We mounted the press-to-talk switch so that the button protrudes through the top rear of the box, near the left hand edge. In this position it can be operated conveniently with the left hand index finger, leaving the right hand free to make notes etc.

The switches were mounted using 12mm long spacers, tapped 1/8in Whitworth. The circular button on the switch is about 10mm (3/8in) diameter, and needs a slightly larger hole in the case.

In most cases the volume control need only be set once, to suit local conditions, and may be mounted on the board, as shown. However, if preferred, it may be mounted away from the board, in a more accessible spot.

And that is about all we need to say about it. We have provided a versatile basic design which should suit almost any application. We leave it to the readers to make it up in whatever form they feel will suit them best.

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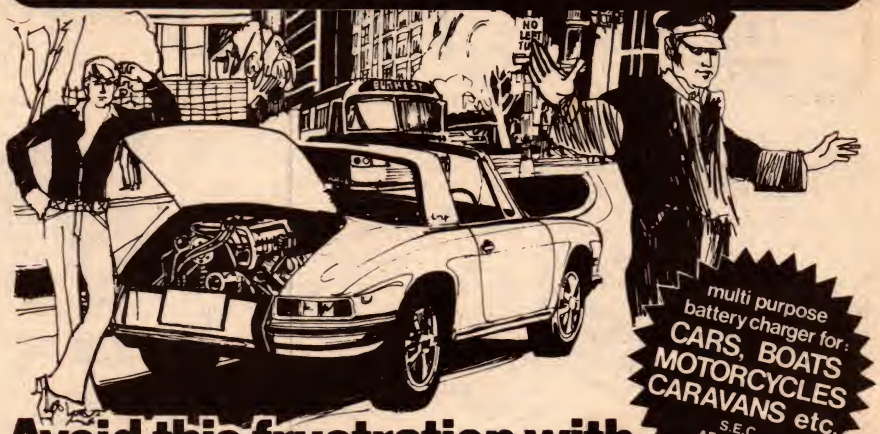

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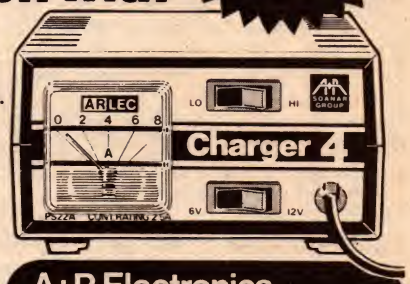

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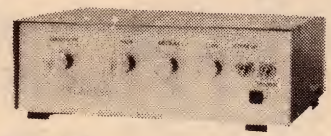

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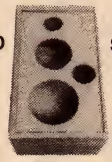

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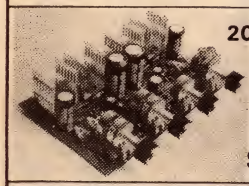

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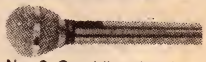

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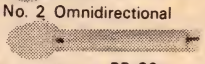
No. 2 Omnidirectional



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C200F05	8"	8ohms	80W	20- 5000Hz	27Hz	9500	607G	3577G	$79.75
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Board No. 3. 7 x 7400, 2 x 7402, 3 x 7404, 2 x 7410, 2 x 7442, 2 x 7473, 2 x 7486, 7493, 5 x 7412 1, 3 x 74152, 4 x 74S387, 1 x 9015, 9602, LM309K.
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INFORMATION CENTRE

INTEL MICROPROCESSOR: So far EA has not told us much about the new 8048 microprocessor put out by Intel — the one with the on-chip RAM and ROM. Is it similar to the good old 8080? Is it expandable? And the really important question: is it a practical alternative to the already established beginner micros like the SC/MP and the 2650, or is it the forerunner of a new generation of micros that should be left alone for the time being until the bugs are smoothed out? (I.D., Sandringham, Vic.)

● The Intel 8048 is a single-chip microcomputer designed primarily for low cost industrial applications. Its ROM is mask-programmable, making it not very suitable for hobbyists. There is a similar device, the 8748, which has an EPROM on the chip in place of the ROM, and this may be of greater interest to hobbyists. However the 8748 is currently still quite expensive.

DWELL METER: I think the Dwell Meter in the July 1977 issue is a great idea. However, I assembled same and it is not working correctly.

On connecting power the meter reads full deflection and can be varied by adjustment of the preset pot. However, the points lead has no effect with engine static — the meter remains at full deflection whether the lead is shorted or open circuit.

Running the engine with the points lead connected results in the meter dropping to a very low level. Also, when connecting the unit with the engine stopped, the unit occasionally gives no meter reading. Disconnecting and reconnecting the leads regains the reading.

I connected the IC as from the photo of your assembly. Perhaps I have connected it the wrong way round? (K. S., Cronulla, NSW.)

● It is normal for the meter to read full scale with the engine stopped or with the points lead not connected. A zero meter reading occurs only when the ignition is on and the points are open.

In other words, a zero meter reading will result only when there is a voltage input to the points lead. The unit can thus be bench tested by connecting the points lead back to the positive supply rail via a 1k resistor. If a zero meter reading results, then it is likely that the unit is functioning normally.

We are at a loss to explain why you should get such a low meter reading when the engine is started. The only situation we can think of, for this to occur is for the points lead to be connected to the wrong side of the coil!

The correct orientation of the IC is determined by a small dot or a notch adjacent to pin 1, as shown on the component overlay diagram.

POLYPHONIC SYNTHESISER: I have just been reading the article by Michael Bauer in the April 1976 issue, describing his design for a polyphonic keyboard.

Would it be possible for your magazine to design a polyphonic music synthesiser project in the near future? If not, then perhaps a monophonic synthesiser for use with the "760" organ. I enjoy reading your magazine, and am especially interested in music projects. Perhaps you might consider an electronic piano, also. (R.B., Galore, NSW)

● A Polyphonic synthesiser is quite a big project, but we will give the suggestion some thought. It may not be as daunting as it would once have been, thanks to modern microprocessors.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

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18	.28	9	.56	PL18/5VA
24	.21	12	.42	PL24/5VA
30	.17	15	.33	PL30/5VA
20VA CHASSIS MOUNTING				
12	1.67	6	3.33	PL12/20VA
15	1.33	7.5	2.67	PL15/20VA
18	1.11	9	2.22	PL18/20VA
24	.83	12	1.67	PL24/20VA
30	.67	15	1.33	PL30/20VA
40	.5	20	1.0	PL40/20VA
50	.4	25	.8	PL50/20VA
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Vs 15, 13.5, 12, 9, 3 Vp 7.5, 6, 1.5			2.67A 5.33A	PL15/40VA
Vs 30, 27, 24, 18, 6 Vp 15, 12, 3			1.33A 2.67A	PL30/40VA
Vs 50, 45, 40, 30, 10 Vp 25, 20, 5			0.8A 1.6A	PL50/40VA
Vs 30V at 0.5A and 9V at 3A Vp 15V at 1.A and 9V at 3A				PL30-9/40VA
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CIRCUIT DIAGRAM and modification notes on US army BC348L receiver. D. Pindar, 53 Rockley Ave, Baulkham Hills, NSW 2153. Tel. 624 4115.

DICK SMITH 10TH ANNIVERSARY 100 PAGE SUPERCATALOG

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NOTES & ERRATA

SINCLAIR PDM35 ADVERTISEMENT (February 1978, page 25). The address for correspondence in this advertisement ws incomplete, and should have read: Consolidated Marketing Corporation Pty Ltd, 1st Floor 308-312 High St, Kew, Victoria, 3101.

LEDs — $15 per 100 — 5mm red with clip $140 per 1000, $8.50 or 20c ea. Retail or trade — sample for 40c stamp. Great quality — wide viewing angle — well difused. Also axial electrocap 1000uF/16V same prices but extra 1c each on 40c P&P. Diggerman Electronics, Box 33, Coramba 2466.

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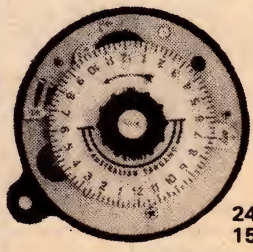

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LANTHUR ELECTRONICS

69 Buchanan Ave, North Balwyn, Vic. 3104.
P.O. Box 162. Ph: 859 4061.

MOTOR SPEED CONTROLLER KITS
Suitable all 240v ac/dc brush type. Controls down to stop without loss of torque. Hand tools, lathes, potters wheels, etc. Suits motors up to 10 amp 2400 watt capacity.
Price including postage **$10.95**

LAMP DIMMER KITS
Will control incandescent lamps from full to out. 10 amp 2400 watt capacity.
Price including postage **$8.50**
If slider type control required instead of rotary. Extra **25c**

CABINETS SUITABLE SPEED & DIMMER KITS
Plastic with alum. lid **$1.75**
Aluminium **$2.95**

BATTERY SAVER KITS
Supplies dc voltages 6 to 15 amp @ 1 amp. Tapped transformer, rect., capacitor and circuit supplied. **$8.95.**
Plus postage. Vic. **$1.00.** Others **$2.00.**

BATTERY CHARGER KITS
Will charge 12 volt wet batteries @ 2 amps. Transformer, rect., ballast resistor and circuit supplied, **$9.95.**
Plus postage Vic. **$1.00.** Others **$2.00.**

Specialists supply electronic components schools, gov. depts., industry, etc.

ELLISTRONICS

ARE PROUD TO ANNOUNCE THE OPENING OF THEIR NEW STORE ON **1st MARCH, 1978**
at
289 LATROBE STREET, MELBOURNE
(Just 3 doors up from Elizabeth Street)

PHONE: MELB. 663-1785

WIDE RANGE OF COMPONENTS

e.g. Semi-conductors, resistors, capacitors, electrolytics, kitsets, communication receivers, test equipment, speakers, knobs, switches, tools, etc.

HIGHLY COMPETITIVE PRICES

2300 SQ FT OF AIR-CONDITIONED DISPLAY SPACE

Electronic Disposals customers please note that our Little Lonsdale St store will still be open for normal trading.

VU METER

1.60

DUE TO A HUGE PURCHASE AND LARGE SALES WE ARE ABLE TO OFFER THIS METER AT A FURTHER BETTER PRICE. METER IS FOUR CENTIMETRE SQUARE WITH A BLACK FACE AND WHITE AND RED LETTERING. BACK LIGHTING IS POSSIBLE. 200uA MOVEMENT.

CHASER DRIVER

CHASER LIGHT DRIVER, AUTO OR MUSIC CONTROLLED FOUR 240 VOLT THREE PIN OUTLETS DRIVING UP TO 1000 WATT EACH. A VARIETY OF SPECIAL CHASING EFFECTS AVAILABLE. VERSATILE AND EYE-CATCHING DISPLAYS CAN BE ASSEMBLED USING THIS DRIVER.

85.00

COLOR DRIVER

MUSICOLOR DRIVER, FOUR CHANNEL MUSIC TO LIGHT CONVERTER. FREQUENCY SELECTIVE, 1000 WATT PER CHANNEL. WATCH THE BEAT IN YOUR MUSIC. IDEAL FOR CHRISTMAS DECORATION.

85.00

PLASTIC BOXES

USEFULL PLASTIC BOXES WITH ALUMINIUM LID. FIVE SIZES. IDEAL FOR PROJECTS REQUIRING ATTRACTIVE PRESENTATION.

UB1.... 6" x 4" x 2"	$ 2.45
UB2.... 8" x 4½" x 2½"	$ 3.95
UB3.... 5" x 2½" x 1½"	$ 2.15
UB4.... 4" x 2" x 1½"	$ 1.55
UB5.... 3" x 2" x 1"	$ 1.45

MM5369

MM5369 SEVENTEEN STAGE OSCILLATOR DIVIDER WHEN USED WITH 3.579MHz CRYSTAL IT GIVES 60Hz OUTPUT. CRYSTAL $4.95

LINEAR IC :	
ZN414, radio chip,	$3.50
TAA840, radio chip,	$3.50
MC1303, dual low noise preamp,	$2.50
MC1314 and MC1315, SQ pair,	$12.00
SL301, dual matched transistors	$3.20
NE555, timer	69c
LM339, quad comparator,	$2.80
LM3302, quad comparator,	$2.00
LM343, HI voltage opamp,	$4.50
LM394, supermatch NPN pair,	$3.20
LM4250, Programmable opamp	$3.50
LED READOUTS :	
FND500, common cathode, .5"	$2.25
FND359, common cathode, .3"	$1.75
MAN7 , common cathode, .3"	$1.95
SPEAKERS :	
4 inch, 8 ohm,	$3.75
5 inch, 15 ohm,	$3.75
IC SOCKETS :	
8 pin, low profile,	30c
14 pin, low profile,	34c
16 pin, low profile,	38c
FERRITE POT CORES :	
FX2242 core and former,	$2.75
F18, AL250, core and former,	95c
F18, AL63, core and former	95c
P25, uE220, core and former	$1.10
P25, uk100, core and former	$1.10
P25, uE68, core and former	$1.10
REED RELAYS :	
Two reeds mounted in coil, heavy duty contacts, 800ohm, 5 volt coil	$2.00
VOLTAGE REGULATORS :	
Flat pack, 7806, 7812,	$1.75
TO3 pack, 7806, 7812,	$2.00
STROBE TUBE :	
Heavy duty, similiar to 1210, ignition contact built in.	$2.75
GAS SENSORS :	
TGS812 and TGS813,	$9.50
CRYSTALS :	
2 MHz, use with 30pF,	$6.95
3.579,	$3.95
ZENERS :	
8.2, 12 and 30V, 500mW,	15c

SLIDE POTS :	
60mm, linear dual gang, 100k, 250k,	25c
60mm, log dual gang, 250k, 4.7k,	25c
45mm, linear single gang, 470k, 1k,	25c
30mm, linear single gang, 1k,	25c
ROTARY POTS :	
Dual gang linear, 25k, 47k, 100k,	50c
Dual gang log , 47k,	50c
Dual gang linear, 470k,	60c
TRANSFORMERS :	
250V CT @ 200mA, 6.3V CT @ 2A, and 15V at 1A, "C" core.	$12.00
17V @ 4.4A. fantastic value at	$8.00
9V @ 500mA AC plug pack,	$5.95
POLYCARBONATES :	
.082, .1, .047, .47, .56,	12c
1.0, 1.5uF,	40c
POLYESTERS :	
.012uF,	10c
POLYSTYRENE :	
270pF, 470pF., .0047uF	15c
CERAMIC :	
5.6pF and 12pF in packs of 100,	$1.00
RCA SOCKETS :	
5 way and 6 way,	45c
TRANSISTORS :	
BC214, BC309, similiar to BC179,	14c
BD139, BD140,	75c
2N2904,	35c
2N3054,	45c
SE7055, (similiar to BF337)	45c
TIP32A,	50c
TIP34A, (similiar to TIP2955)	75c
NSD206, (similiar to TT801)	40c
2SD200, (similiar to BU205)	$2.95
DIGITAL IC :	
7440, 7442, 7445, 7453, 7460,	30c
7470, 7472, 7474, 7479,	49c
7480, 7483, 74121, 74151,	65c
74154, 74141,	$1.00
1101 memory	30c

ETI582	HOUSE ALARM (A AND B)	$ 79.50
	ETI582A	$ 2.70
	ETI582B	$ 1.50

LOOK AT THIS SELECTION OF DIGITAL AND LINEAR INTEGRATED CIRCUITS. EXOTIC DEVICES AND SOME OF THE COMMON BUT HARD TO GET.....

MK50395 SIX DECADE COUNTER, LATCH, DECODER, PRESETTABLE, UP-DOWN, INTERNAL SET REGISTER AND COMPARATOR, LEADING ZERO BLANKING. DATA SUPPLIED. $23.50

AY3-8550 NEW GAMES CHIP REPLACES 3-8500 IN CIRCUIT WITH NO CHANGES. ADDITION OF A FEW EXTRA COMPONENTS AND PAN POTS ALLOWS VERTICAL & HORIZONTAL MOVEMENT OF BATS. PRICE INCLUDES TWO PAN POTS. $18.50

GET SWITCHED ON WITH THESE ROTARY SWITCHES. AT THESE PRICES THERE'S NO COMPETITION. AVAILABLE—IN ONE, TWO AND THREE SECTION.

ONE SECTION...	1 POLE 12 POSITION		
	2 POLE 5 POSITION		$1.20
	3 POLE 4 POSITION		
	4 POLE 3 POSITION		
TWO SECTION...	1 POLE 12 POSITION		$2.20
	2 POLE 5 POSITION		
	3 POLE 4 POSITION		
THREE SECTION.	2 POLE 5 POSITION		$3.20
	3 POLE 4 POSITION		

DON'T LET YOUR PROPERTY TURN INTO A BOMB. USE THIS DETECTOR KIT TO DETERMINE IF FUMES , GAS PRESENT. FEATURED IN ELECTRONICS AUSTRALIA 77 MAY ISSUE.....

GAS ANALYSER MARINE KIT	$27.50
AUTO KIT	$27.50
PORTABLE KIT	$17.50
812 TGS	$10.50
813 TGS	$10.50

POSTAL ADDRESS :

BKX ELECTRONIC SUPPLY SERVICE,
PO BOX 787, POTTS POINT,
SYDNEY, 2011.

MAIL ORDER MINIMUM.....$8.00
P&P.....FREE IN AUSTRALIA.
TEL.....02.....358 2420

BKX Electronics Supply Service

OUT IT GOES.... A CLEARANCE OF EXCESS STOCK AT RIDICULOUS PRICES. AT THIS PRICE ONLY WHILE PRESENT STOCKS LAST..... GET YOURS NOW.

bankcard

179 VICTORIA ST., KINGS CROSS N.S.W. 2011

BKX ELECTRONIC SUPPLY SERVICE
PLEASE DEBIT MY BANKCARD ACCOUNT
NUMBER.....
SIGNATURE.....
NAME.....
ADDRESS.....
.....
.....

SOME OF AUSTRALIA'S LOWEST COMPONENT PRICES

ELECTROCAPS (UPRIGHT)
(per 100 prices in brackets)

Cap.	16V	25V	50V
0.47 uF thru to 10 uF	all 5c($3½)	all 6c($3¾)	all 7c($4)
22 uF	6c($3¾)	7c($4)	8c($5)
33 uF	8c($4)	9c($5)	10c($6)
47 uF	9c($5)	10c($6)	11c($7)
100 uF	10c($6)	12c($7)	14c($11)
220 uF	12c($8)	16c($10)	35c($17)
470 uF	16c($12)	22c($16)	45c($30)
1000 uF	22c($18)	30c($25)	75c($50)

1000 uF/16V axial — 20c ea. $8 per 50
2200 uF/50V axial — 95c ea. $8 per 10
Full axial price list — SAE

POLYESTER FILM CAPS
E12 10% 100V
All values .001 to .01 — 7c ea.

.01 - 7c	.1 - 13c
.012 - 8c	.12 - 14c
.015 - 8c	.15 - 14c
.018 - 8c	.18 - 14c
.022 - 8c	.22 - 16c
.027 - 8c	.27 - 16c
.033 - 8c	.33 - 18c
.039 - 9c	.39 - 19c
.047 - 9c	.47 - 22c
.056 - 9c	All values in uF
.068 - 10c	
.082 - 10c	

10% off 100 same cap.

LEDs: $12 per 100, $110 per 1000, or 17c each, 10 for $1.50, clips 3c each all quantities. LEDs superb — 5mm red — well difused. Wide viewing angle — sample 40c stamp.
2c RESISTORS: Our 2-year-old price still current. Opposition hoped we would go broke, but our price remains at 2c ea. 1 Ohm to 10 M ¼W 5% E12 carb. film $1.80 per 100 same value (or ½W 3c, $2.50 per 100 same value).
POTENTIOMETERS: 50c ea. Rotary Carb. single gang — log or lin: 1K, 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M (metal shafts).
TRIM POTS: 17c ea. — 10mm .1W horiz or vert: 100 Ohm to 2M

Quality assured — same day turnaround service (unless swamped).
No minimum order. PP 40c regardless size. SAE full price list.

DIGGERMAN ELECTRONICS
PO Box 33, Coramba, NSW 2466

SUPER SPECIALS WHILE STOCKS LAST

PRINTED CIRCUIT LAMINATES Copper clad 1 oz on one side

175mm x 100mm x 1.6mm Phenolic	$0.40
200mm x 190mm x 1.6mm Phenolic	$0.65
150mm x 75mm x 1.6mm Fibreglass	$0.40
230mm x 115mm x 1.6mm Fibreglass	$0.70
235mm x 160mm x 1.6mm Fibreglass	$1.00

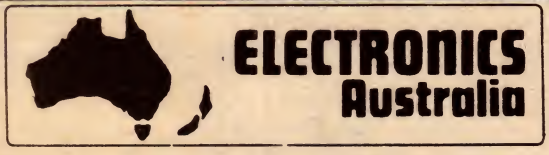
555	Timer	$0.50	74164 8 Bit SI PO Shift Register $1.40
723	Regulator (DIL)	.70	74165 8 Bit SI PO Shift Register 1.40
741	Op Amp (mDIP)	.40	4001 Quad 2 Input NOR Gate. .28
747	Dual Op Amp	1.00	4016 Quad Bilateral Switch .65
7475	Quad Bistable Latch	.65	1N4148 Diodes .05
7493	4 Bit Binary Counter	.60	PA60 600PIV 8A Bridge Rectifier 5.00
7495	4 Bit RS LS Register	.85	NSL5053 0.2" Red LED c/w mtg .25
7496	5 Bit Shift Register	1.00	2N3055 Transistor c/w washers .80

RELAYS 12V 1 Changeover Contacts
2A/50VDC 4A/250VAC 27.5 x 13 x 10.5mm high $2.30

LOTS MORE DISCOUNT COMPONENTS STOCKED — WRITE FOR YOUR FREE COPY OF OUR LATEST ILLUSTRATED CATALOGUE.
PACK AND POST 50c MINIMUM — ALLOW MORE FOR HEAVIER ITEMS.

LINEAR ELECTRONICS P.O. BOX 254, PUNCHBOWL 2196

SUBSCRIPTION SERVICE



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Postcode ..... **Enclosed is** ..... **for** ..... **years**

ADVERTISING INDEX

Why blame your tape recorder for problems caused by your tapes?

Every day people all over the country go into hi fi dealers with complaints about their tape recorders.

When in reality what they should be complaining about is their tapes.

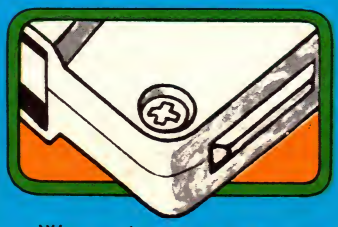
Because the fact is, a lot of the problems that plague tape recorders can be attributed to bad tape.

HEAD WEAR IS CAUSED BY YOUR RECORDER. OR IS IT?

If you have to clean your tape heads more than usual ... for example ... it could be that your tape doesn't have a special nonabrasive head cleaner.

Maxell has one.

If your recorder jams, it can be any number of things. Maxell does something to prevent all of them happening.



We make our cassette shells of high impact polystyrene. And then so they won't crack even after years of use, we finish them to tolerances as much as 60% higher than industry standards.

JAMMING IS CAUSED BY YOUR RECORDER. OR IS IT?

Inside, we use free rolling Delrin rollers so the tape doesn't stick.

And finally, we screw instead of weld everything together because screws make stronger cassettes.

If your tape recorder frequently suffers lapses in sound, it could be the tape is of inferior quality.

Maxell tape is made of only the finest polyesters. And every inch of it is checked for even the slightest inconsistencies.

POOR TRACKING IS CAUSED BY YOUR RECORDER. OR IS IT?

So if you're having problems with your recorder, try a Maxell cassette, reel-to-reel tape.

You might find there's really nothing wrong with your tape recorder, just with your tape.

Switch to Maxell!

maxell
simply excellent

For all Maxell Recording Tape write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

WT4/79

Pro. Series

Technics DC 'Flat Series'. Components literally made for each other.

In creating the 'flat' system, Technics engineers separated the basic amplifier / tuner into five components, researched and developed each, then recombined them into a system of audio excellence.

The system consists of:

Stereo Tuner (ST-9030) with wide and narrow IF bands.

Stereo DC Preamp. (SU-9070) with phono signal-to-noise ratio of 88dB (for 2.5 mV input).

Stereo Universal Frequency Equaliser (SH-9010) for exact response control in any acoustic environment.

Peak / Average Meter Unit (SH-9020) for exact response measurement.

Stereo / Mono DC Power Amplifier (SE-9060) with all-stage direct-coupled pure complementary symmetry circuitry. Total harmonic distortion is 0.02%.

Each individual component offers a degree of fidelity in sound reproduction, and a flexibility and ease of operation that makes it a natural choice for the audio fan who cannot be content with less than the best.

National Technics hi-fi

WARRANTY AND SERVICE BY HACO

For a National Technics Catalogue, please write to:
National Technics Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033.

T78.16